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A brief but urgent appeal to the friends of Isis and of the H. S. S.

Because of the increase in printing costs the Society will not be able to pay for more than about 350 pages of *Isis* and yet some 600 pages are printing or ready to be printed, some 200 pages of important manuscripts have already been accepted and more are coming almost every week.

A very difficult situation has to be met because, in the first place, interest in the history of science within a relatively small circle of scholars is growing much faster than the academic and popular support of those studies; and because, in the second place, the encyclopaedic nature of our endeavour obliges us to publish abundant material in order to satisfy as much as possible every group of readers. In other words the capacity of *Isis* ought to be increased in spite of the fact that printing is becoming more expensive and that our membership is not growing fast enough. In order that every main branch of science and every period of history be sufficiently represented in each volume (outside of the Critical Bibliographies), we ought to be able to publish annually some 1,600 pages. A few more years will probably elapse before we are able to do that, but that must be our aim if we are determined to accomplish our great purpose.

Very few people have as yet understood that if we want to humanize science, that is, to reconcile the idealism of the scientist with that of the man of letters and the artist, we must, first of all, study the past of science as thoroughly as humanists have studied other portions of our patrimony. This will require an immense and very austere effort and we must be equal to it.

Whatever remains unpaid by the H. S. S. will have to be paid for ultimately by the Editor who accepts, now as heretofore, full financial responsibility. However, the Editor is a poor man who must earn, in the unprofitable way of scholars, almost every dollar that he spends. Members, who could afford to help *Isis* and the cause of the History of Science in this emergency would acquire considerable merit by so doing. For example, they might undertake to cover the expenses incidental to the printing of a single number of *Isis*. Donations will be gratefully received by the Editor or by the Treasurer of the H. S. S. and acknowledged in *Isis*.

January 17, 1926.

GEORGE SARTON.

Sur la tolérance intellectuelle.

Si l'étude de l'histoire de la science ne nous a pas inculqué plus de tolérance intellectuelle, nous avons laissé s'en échapper le meilleur fruit, nous avons vraiment perdu notre temps à l'apprendre. Et d'ailleurs si nous sommes trop intolérants et d'un tempérament trop jaloux, il vaut mieux ne pas nous occuper d'histoire, car nous resterons incapables d'en avoir une vue juste et complète.

* * *

Il y a beaucoup d'années comme je me promenais dans la bonne ville de Gand, en Flandre, je vis venir à moi de l'autre côté de la rue un vieil homme. Je le connaissais bien car nous avions souvent causé ensemble, mais il avait été récemment accusé d'avoir commis une très vilaine action et des amis m'avaient donné à entendre que cette accusation était fondée sur des faits irrécusables. Donc quand il fut arrivé près de moi, j'affectai de ne point le voir et je passai outre. Depuis, j'ai souvent rêvé d'avoir quinze ou vingt ans de moins et de pouvoir ainsi recommencer la meilleure portion de ma vie. N'avez-vous jamais fait le même rêve? Comme ce serait bon de pouvoir refaire ainsi une partie du chemin, d'éviter les erreurs commises, fut-ce au prix de nouvelles déceptions. Cependant mon rêve n'était pas tant de retrouver les jours de l'adolescense, si désirable que cela fût; il était beaucoup plus humble. Je rêvais que je me promenais dans la bonne ville de Gand et qu'un vieil homme s'avançait vers moi. On m'en avait dit beaucoup de mal. Cependant je ne me détournais pas de lui, mais je lui serrais la main comme à un frère.

* * *

Comment osons-nous nous permettre de juger autrui avec tant de légèreté et parfois irrévocablement? Nous prenons des précautions infinies dans nos cours de justice; nous n'y punissons personne sans avoir entendu et discuté tous les témoignages pour et contre, sans avoir épuisé toutes les sources d'information, sans avoir donné à l'accusé tout le bénéfice de nos doutes. Et cependant dans la vie

privée nous n'hésitons guère à prononcer des jugements parfois plus redoutables que ceux des tribunaux sans avoir entendu l'autre partie et même sans avoir fait un effort sérieux pour l'entendre. Qu'est-ce qui nous donne cette audace? Nous qui ne sommes pas méchants, comment pouvons-nous être si cruels? Nous qui nous croyons justes, comment pouvons-nous être si injustes? Qui sommes-nous donc pour assumer de telles prérogatives ? Notre moralité et notre science ne nous donneraient point une telle audace, bien au contraire. La vraie source de cette audace, si nous ne sommes pas foncièrement mauvais, c'est notre ignorance. C'est parce que notre ignorance d'autrui est si profonde, que nos jugements nous paraissent si solides.

Arrêtons-nous un moment. Interrogeons-nous. Je parlerai de moi pour la facilité, mais moi, c'est aussi vous. J'ai visité hier un criminel dans sa cellule. Un vrai criminel : il a préméditté son crime et l'a commis en plein jour en présence de beaucoup de témoins; sa victime a eu assez de force avant de mourir pour confirmer l'accusation; lui-même a tout avoué. Quant à moi je ne suis pas un criminel; je n'ai jamais commis de crime dans ma vie, pas même en pensée. Le pis que j'ai jamais fait dans cette direction c'est de lire quelques articles nécrologiques avec plaisir, mais je n'ai jamais désiré, même dans le plus secret de mon cœur, que les jours de personne fussent abrégés. Cet homme que j'ai visité dans sa cellule est un criminel; je n'ai, moi-même, jamais commis de crime. En résulte-t-il que je vaille mieux que lui? Ai-je le droit de me considérer son supérieur? Il faudrait pour cela que toutes nos qualités et que tous nos vices eussent une commune mesure et que nous puissions les peser tous. Qui tiendra la balance? Qui y mettra les poids? Qui fera la comparaison? Vous? ou moi? Non, personne. Il n'y a pas de commune mesure.

La société a le droit et le devoir de punir cet homme, mais elle est incapable de le juger. Aucun jugement complet et final n'est possible ni permis. Qu'il expie son crime et quant à nous, si nous voulons être charitable, gardons le silence.

* * *

S'il est impossible de juger équitablement des individus isolés, comment pouvons-nous songer à juger des nations, des peuples entiers? Et cependant, non seulement nous les jugeons bien souvent mais, qui pis est, nous assumons une attitude de supériorité qui serait offensante même si elle était justifiable, mais qui dans l'espèce

est à la fois offensante et ridicule. Nous n'avons pas de moyens scientifiques pour mesurer nos qualités et nos vices, mais chaque peuple adopte inconsciemment une échelle de valeurs à l'aide de laquelle il prétend mesurer la bonté des autres peuples. Cette échelle est son échelle; il attribue naturellement un très grand poids à ses qualités propres et n'attache que peu d'importance à ses vices. Quand il se mesure ainsi, il en résulte évidemment qu'il est beaucoup meilleur que les autres, mais le tout n'est qu'illusion et tromperie.

Et comment voulez-vous que des amitiés internationales subsistent, si chacun entend les subordonner à une admission de sa propre supériorité et de l'infériorité des autres? Je suis tout prêt à reconnaître mes défauts et mes faiblesses si on ne m'y pousse pas trop. Mais si l'on veut m'y forcer, si d'autres hommes refusent de m'accorder leur concours à moins que je n'admette leur supériorité, je me rebelle. Il importe peu que cette supériorité soit réelle ou non, car elle n'est pas mesurable, et si l'on écarte les cas de disparité évidente, elle n'est pas même appréciable. Tout ceci est assez vrai des individus, mais il est infiniment plus des peuples, car dans leur cas, les éléments à comparer sont infiniment plus nombreux et il n'existe de mesure commune pour aucun.

Et s'il est vrai que les hommes qui se glorifient de leur supériorité se nuisent et se diminuent, que devrons-nous penser des nations qui nous offrent le spectacle des mêmes aberrations, du même manque d'imagination et d'intelligence ? Celui qui affirme lui-même sa supériorité, qu'il s'agisse d'un individu ou d'un peuple, donne par là même une preuve d'infériorité. De telles affirmations sont d'ailleurs les plus grands obstacles au progrès. Celui qui est si satisfait de lui-même, pourquoi changerait-il ? et s'il est parfait, à quoi bon faire de nouveaux efforts? Le vrai patriotisme ne consiste pas à proclamer la supériorité réelle ou imaginaire de son pays, mais à l'aimer tel qu'il est, petit ou grand, faible ou puissant, et à le vouloir meilleur.

Pour en revenir à nos chères études, il est difficile de comprendre cette forme de l'aberration chauvine qui pousse quelques savants à revendiquer pour leur pays toutes espèces de priorités scientifiques, parfois en dépit de l'évidence. Qu'espèrent-ils donc gagner? Ces gens ont une mentalité d'avocat plaidant une cause; ils semblent croire que le renom de leur pays dépend, non pas des faits eux-mêmes, mais de leurs plaidoiries. Comme tout cela est futile! Ce

qui importe uniquement c'est notre propre valeur, et non pas nos affirmations y relatives, ni celles de nos amis ou de nos ennemis. Tous nos panégyriques n'y ajouteront rien et les calomnies de nos ennemis n'y retrancheront rien non plus. Comme le disait si simplement l'évêque BUTLER : « Les choses sont ce qu'elles sont et leurs conséquences seront ce qu'elles seront; pourquoi désirerions-nous être trompé ? »

L'intolérance intellectuelle est généralement causée par des revendications de supériorité et par le désir charitable de hisser autrui à son propre niveau. Si la supériorité était réelle et certaine, cela serait fort bien, mais elle ne l'est point. Elle l'est si peu qu'elle est le plus souvent contrecarrée par d'autres revendications équivalentes mais incompatibles : de là, tous les grands conflits intellectuels de l'histoire, les querelles philosophiques, les haines théologiques, les guerres de religion, qui illustrent remarquablement la bêtise humaine. Car si la force peut parfois trancher des difficultés politiques et économiques, il devrait être évident qu'elle est absolument impuissante à résoudre des différends intellectuels. Nous ne pouvons absolument rien gagner à vouloir imposer par la force nos idées, nos façons de voir, ou notre religion à d'autres peuples. Quand saint PAUL déclarait : « Je voudrais que tous devinssent tel que je suis moi-même », il exprimait sa foi profonde, mais il déposait ainsi dans son propre cœur et dans celui des autres un germe d'intolérance. Il parlait en homme d'action, qui est dominé par une doctrine dont il ne doute point et qui ne se soucie guère de l'indépendance d'autrui. « Quelle indépendance? » aurait dit saint PAUL. « Je leur indique la bonne voie; devrais-je les laisser en suivre une mauvaise et se perdre pour toujours? » Mais l'attitude de l'historien et celle du philosophe sont essentiellement différentes de celle de l'homme d'action. L'historien doit rester strictement impartial et dégager les faits historiques aussi complètement que possible de leur gangue; il doit aimer la vérité par dessus tout, sans peur, sans fléchissement, sans compromis. Le philosophe ne se dira point : « Je voudrais que les autres fussent tel que je suis », mais plus humblement : « Je voudrais devenir meilleur que je ne le suis. »

La vraie tolérance implique à la fois une grande sympathie pour autrui et une profonde humilité. Sans la sympathie, la tolérance resterait tout à fait passive et sans vertu; ce serait plutôt de l'indifférence et de l'égoïsme. Sans humilité, elle se détruirait elle-même; la conscience de notre supériorité nous conduirait tôt ou tard à persécuter nos frères « pour leur bien ». Tandis que le sectaire

s'hypnotise dans la contemplation de ses propres qualités et des défauts d'autrui, l'homme vraiment tolérant ne perd jamais de vue ses propres faiblesses et s'efforce de découvrir ou de mieux connaître les qualités de ceux qui l'approchent. Après tout, le moyen le plus direct et le plus sûr qui soit à la disposition de chacun pour améliorer le monde, c'est de s'améliorer soi-même.

* * *

Il est assez naturel que les hommes comprennent leur propre travail, surtout s'il s'agit de savants qui ont dans une large mesure choisi eux-mêmes leur domaine d'activité et qui jouissent ainsi de l'inestimable privilège de poursuivre une vocation. Mais il est relativement rare de rencontrer des savants qui comprennent bien le travail d'autres savants qui ne suivent pas la même route, et chose étrange, ils s'y intéressent souvent d'autant moins que cette route est plus voisine de la leur. Un exemple bien connu est celui des systématistes et des physiologistes. Il est assez amusant d'entendre ce que ceux-ci disent de ceux-là. Mais leur dédain qui leur paraît à eux-mêmes si justifié, ne prouve que leur manque d'imagination. L'observateur désintéressé aurait du mal à choisir entre la biologie systématique et la physiologie; il se rend compte qu'on ne saurait établir entre elles de hiérarchie certaine; il s'agit là simplement de deux méthodes d'approche de la réalité, fort différentes, mais également indispensables. On pourrait peut-être soutenir que le point de vue physiologique, fonctionnel, dynamique est supérieur au point de vue morphologique, descriptif, statique. Mais quoi qu'il en soit, il est tout à fait certain que de la bonne morphologie vaut mieux que de la mauvaise physiologie. Ce qui importe surtout, en science comme ailleurs, ce n'est pas tant ce que nous faisons que notre manière de le faire.

Il y a des savants dont l'esprit est étroit; il y a des mathématiciens bigots de même qu'il y a des catholiques ou des méthodistes bigots, et pour les mêmes raisons. Ils suivent leur propre ornière sans s'occuper des autres, et s'hypnotisent à penser que cette ornière est une des grandes routes du monde. C'est du provincialisme intellectuel, une forme d'intolérance passive. Le but de nos études est en partie de combattre ou de mitiger ce provincialisme, de rendre cet isolement à la fois plus difficile et plus antipathique, en démontrant sans cesse l'unité essentielle de la science et l'unité essentielle de l'humanité.

Il est clair qu'à ce point de vue comme à tous les autres, les aptitudes de chaque individu sont limitées. Certains sont nés sectaires et provinciaux; d'autres le deviennent. Certains ne développent complètement que quelques qualités intellectuelles et semblent incapables d'en apprécier, et même d'en concevoir d'autres. Ce sont là cependant des exceptions. J'imagine que dans la plupart des cas, le provincialisme et l'étroitesse d'esprit sont dus, tout au moins en partie, à une éducation défectueuse, à une spécialisation hâtive. Je pense que les potentialités intellectuelles de la plupart des savants ne sont développées que d'une manière très imparfaite. Il serait possible, et même facile, d'élargir considérablement leur horizon.

Déjà si les circonstances de leur éducation et de leur vie professionnelle les obligeaient plus souvent à analyser la pensée d'autrui, leurs conceptions de la science et de la vie même en deviendraient plus généreuses. Mais le meilleur moyen de compléter leur développement à cet égard, c'est évidemment de les inviter à contempler plus souvent non seulement les derniers résultats, mais aussi tout le passé de la science. Ils obtiendraient ainsi une vision concrète et impressionnante de l'unité de la science et de l'humanité. De même que les voyages nous aident à concevoir que nos façons de faire, de penser et de sentir ne sont pas les seules, et nous font saisir sur le vif la relativité de nos points de vue dans l'espace, de même les études d'histoire, tels des voyages dans le passé, nous obligent à comprendre la relativité de nos points de vue dans le temps. A moins que nous n'y soyons tout à fait réfractaires et que nos préjugés ne soient trop profondément enracinés, l'histoire et la géographie corrigent notre trop bonne opinion de nous mêmes; elles brisent notre provincialisme et augmentent, autant que faire se peut, notre sympathie et notre générosité natives.

* * *

L'intolérance est dans une large mesure un résultat de l'ignorance, mais elle a encore d'autres sources. La plus commune, c'est cet esprit grégaire qui est aussi la source de la solidarité humaine. Les hommes vivent en troupeaux et l'approbation qui leur est le plus nécessaire, c'est vraiment celle du troupeau auquel ils appartiennent. Ils y tiennent tellement qu'ils sont prêts à tout pour l'obtenir. S'ils ont la bonne fortune d'appartenir à un troupeau supérieur, je veux dire, un troupeau dont la supériorité est assez généralement admise par les autres, leur intolérance des autres troupeaux s'arme de cet

orgueil collectif qui les dispense d'avoir aucun mérite personnel. Leur propre médiocrité est noyée dans la gloire du groupe. Ils semblent se venger de leur obscurité individuelle en tirant parti le plus souvent possible de la supériorité qu'ils partagent avec tant d'autres. Ils me font penser à ces laquais de grande maison qui regardent avec dédain les amis pauvres de leurs maîtres. Ils se vengent de leur servitude en s'enorgueillissant de leur livrée.

Il y a aussi l'intolérance des vieillards, intolérance cruelle et froide si différente de l'intolérance étourdie et superficielle des jeunes gens. Celle-ci est plutôt ridicule que haïssable; elle fait sourire; c'est le fruit d'un manque d'expérience qui est si naturel à la jeunesse qu'on ne peut guère lui en tenir rigueur. Celle-là est plutôt une arme de combat, — la dernière. Il reste encore possible de détruire quand la force créatrice s'est tarie et d'arrêter les autres quand on n'a plus la force d'avancer soi-même. Cette intolérance sénile est pitoyable, et si l'on comprend toute la tragédie qu'elle dissimule, on perd la force de la haïr. Il en est ainsi de toute intolérance d'ailleurs, car celle-ci est toujours le symptôme d'une certaine faiblesse, d'une imbécillité, d'un développement incomplet, d'un avortement intellectuel. Dès qu'on en a compris l'origine et la nature, on cesse de s'en irriter et on la tolère tranquillement. Du reste, il n'y a pas de meilleur moyen de la désarmer que de la tolérer, ou plutôt de l'ignorer.

Mais qui que nous soyons et quoi que nous fassions, nous ne serons jamais tout à fait tolérants. Tout d'abord nous ne pouvons nous empêcher d'être impatients — si nous sommes jeunes, parce que nous voudrions marcher plus vite et qu'il nous semble arriver partout les derniers; si nous sommes vieux, parce que nous sentons que la vie nous glisse entre les doigts et que l'allure des autres nous paraît trop rapide. Pour être vraiment patients il faudrait que nous fussions éternels, — et la vie passe. Le grand secret de la tolérance c'est donc de vivre comme si nous avions toute l'éternité devant nous. Et en vérité nous ne pouvons accomplir de grandes choses que si nous oublions combien la vie est passagère; en d'autres mots, que si nous oublions notre propre personnalité : car si belle et haute que soit celle-ci, elle n'est après tout qu'une manifestation éphémère d'une réalité plus profonde mais secrète, le feuillage saisonnier d'un arbre séculaire.

Et puis, l'histoire de la science nous prouve combien il est difficile, même pour les hommes de génie, de comprendre les idées vrai-

ment nouvelles. Ceux mêmes à qui nous devons les plus grandes révolutions intellectuelles se montrèrent souvent incapables de faire des découvertes qui paraissaient presque mûres à leur époque ou de saisir toute la portée d'autres découvertes contemporaines. Léonard de Vinci ne comprit jamais la circulation du sang, ni Harvey le système lymphatique. Bacon explique la méthode expérimentale, mais se montre incapable d'apprécier les meilleurs fruits de cette méthode quand d'autres les obtiennent. Newton néglige les résultats de Huygens. Comte dédaigne Quetelet. Il serait facile d'allonger cette liste presque indéfiniment. Il semble que la capacité d'originalité soit limitée, même chez les plus grands. Il ne faut donc point s'étonner que le commun des hommes ait si peur des innovations. Toute idée nouvelle lui paraît d'abord pernicieuse et, d'instinct, il commence par s'y opposer. Et pour y ouvrir son esprit, il doit faire apparemment un si grand effort qu'on ne peut s'attendre à ce qu'il recommence une opération aussi pénible bien souvent.

Ceci nous donne une autre raison de tolérer même l'intolérance. Il ne sert de rien de brusquer les choses. Il vaut mieux attendre patiemment. Si nous avons raison, nous aurons nécessairement raison un jour — peut-être après notre mort — par la force même des choses; et si nous avons tort, ce qui est fort possible, nous devrions considérer l'intolérance d'autrui à notre égard comme un bienfait. L'eau s'écoule des montagnes vers les plaines; l'entropie de l'univers augmente; la vérité refoule l'erreur : cette évolution est lente, mais irrésistible. Est-elle vraiment lente d'ailleurs? Qu'en savons-nous? La vérité n'est pas lente; c'est notre misérable vie qui est courte.

Il est difficile et parfois impossible d'être tolérant dans la vie que nous vivons, mais il est plus facile de l'être à l'égard du passé. L'histoire est la grande école de tolérance. Si nous ne pouvons nous empêcher d'être parfois injustes à l'égard de nos contemporains, efforçons-nous tout au moins d'être justes — plus que justes, généreux — à l'égard de ceux qui sont morts, de ceux dont l'œuvre est accomplie. Interrogeons-les avec bonté, écoutons-les avec sympathie. Il est vrai que certains historiens sont incapables de tolérance et semblent n'explorer le passé que pour élargir le champ de leurs animosités et de leurs jalousies. Il y aura toujours des historiens intolérants comme il y aura toujours des savants mesquins, des philosophes pusillanimes, des prêtres immoraux et de mauvais bergers. Il n'en reste pas moins vrai que c'est aux historiens qu'incombe essentiellement la grande œuvre d'arbitrage, de réconciliation,

d'apaisement. Malheureusement une très grande majorité d'entre eux ignorent tout de l'évolution des sciences positives, qui constitue la chaîne et la trame du progrès humain, et sont par là même incapables de bien comprendre celui-ci et de bien remplir leur rôle pacifique. C'est en grande partie à cause de cela — la banqueroute de l'histoire — que la tolérance intellectuelle est encore si rare.

* * *

L'intolérance est souvent causée par le manque d'imagination. Les hommes sont si absorbés par leur propre tâche qu'ils ont parfois du mal à concevoir l'utilité ou l'importance d'activités différentes de la leur. Le savant dédaigne l'artiste, l'homme désintéressé dédaigne celui qui ne travaille que pour de l'argent. Et cependant la vie exige la collaboration de tous. Si tous les hommes étaient désintéressés, il est probable que l'organisation sociale en deviendrait à certains égards beaucoup plus difficile. Ceux qui désirent de l'argent sont souvent prêts à faire de grands sacrifices pour l'obtenir; il est relativement facile de les discipliner et de leur faire produire pour la société leur maximum d'efforts. Les gens désintéressés sont plus indépendants, plus capricieux; c'est vraiment eux qui accomplissent la fonction essentielle de l'humanité, mais on ne peut guère leur donner d'ordres ni trop compter sur eux. Ils suivent avec plus ou moins de succès leur propre voie et l'on doit souvent se borner à les contempler avec sympathie, à les aider discrètement et à les laisser tranquilles. Ils sont les vrais artisans du progrès humain, mais précisément à cause de cela, ils menacent de bouleverser à chaque instant l'ordre établi. La stabilité sociale est garantie par la grande masse des individus dont la collaboration est plus humble, mais mieux définie. De même que les hommes d'affaires s'aperçoivent vite qu'il est moins coûteux de faire faire les besognes quotidiennes par des professionnels dûment salariés que de les confier à des amateurs bénévoles, de même les besoins immédiats de l'humanité dans son ensemble sont mieux satisfaits par des gens qui trouvent leur avantage pécunier à la servir que par des philanthropes dont la collaboration manque parfois de continuité et dont les idées généreuses ne sont pas nécessairement justes.

S'il faut de l'imagination pour apprécier à leur juste valeur des activités très différentes de la nôtre, il en faut encore plus — et c'est ici que la plupart échouent — pour comprendre des visions intellectuelles différentes, pour supporter avec sympathie les réac-

tions de sensibilités différentes. Et cependant, il faut bien se dire que toutes ces différences sont probablement nécessaires : il faut toutes espèces d'hommes et de femmes pour constituer le monde infiniment divers et harmonieux où nous vivons, il faut aussi toutes espèces de savants pour élaborer lentement l'image de ce cosmos, la science. Il y a des rêveurs et des hommes d'action, des manieurs d'argent et des manieurs d'idées, des romantiques et des classiques, des introvertis et des extrovertis, des esprits concrets et des esprits abstraits, analytiques et synthétiques, descriptifs et dynamiques, et ainsi de suite indéfiniment. Pour apprécier tout le prix de ces différences qui sont enchevêtrées à l'infini, il suffit de se figurer un instant l'horreur d'un monde où tous les hommes penseraient de même, agiraient de la même manière et réagiraient tous avec l'exactitude et l'uniformité exaspérante d'instruments de musique bien accordés. Ce serait vraiment infernal. Parmi toutes les bénédictions de notre courte vie — et il y en a tant, si pauvres et chétifs que nous soyons — une des plus grandes, c'est cette variété infinie des hommes et des femmes qui nous croisent sans cesse, ceux que nous cherchons, ceux qui nous cherchent, ceux qui nous heurtent, ceux qui nous échappent...

L'histoire nous enseigne que tous ces tempéraments en apparence discordants, que toutes ces intelligences diverses étaient indispensables pour accomplir les besognes complexes de l'humanité. Chacun a son heure d'utilité, de service et d'héroïsme. On aime à se moquer des pompiers, mais qu'un incendie éclate et ils deviennent les héros du jour. Les poètes paraissent souvent inutiles, mais il y a des heures sacrées où ils sont vraiment les seuls à pouvoir exprimer les émotions de la foule. Notre expérience personnelle confirme ces leçons du passé : la beauté mouvante du présent n'est que le reflet de cette complexité infinie. Et l'avenir! Je sais qu'il y a des fanatiques qui rêvent d'un avenir où la race humaine serait modelée uniformément à l'exemple du canon religieux ou social de leur choix, mais nous rêvons plutôt d'une diversité plus grande, d'où les dissonances dues à l'injustice, à l'ignorance, à la superstition, au manque de charité et d'intelligence seraient graduellement bannies et remplacées par des milliers d'accords nouveaux. L'uniformité, fût-ce même une uniformité de bonheur et de vertu, serait intolérable.

* * *

Le grand paradoxe de la vie humaine, c'est que toutes les œuvres immortelles, toutes les œuvres qui, en dernière analyse, sont les

seules à justifier notre existence, sont accomplies par des individus isolés, et que cependant ceux-ci ne pourraient rien faire, et que leur activité même n'aurait pas de sens, sans la foule immense qui les entoure, les nourrit, les encourage ou les étouffe. Si l'humanité a un but — et il semble bien qu'elle en ait un, puisque depuis les débuts de l'histoire elle se meut lentement, mais inflexiblement dans une direction bien déterminée — il est clair que ce but doit être de créer de la beauté, d'organiser la justice, de dévoiler la vérité. Ce but est plutôt de créer des symphonies que de faire de la cuisine, et cependant les musiciens doivent manger et ils deviendraient vite incapables de composer et de jouer de la musique si personne ne les écoutait.

L'organisation du monde est à ce point de vue très semblable à celle de notre corps. Il n'est pas possible de dire que tel ou tel organe essentiel soit plus nécessaire que tel autre; nos reins nous sont aussi indispensables que la substance grise de notre cerveau. Celle-ci ne peut subsister sans ceux-là. Et cependant il y a une hiérarchie entre ces organes : soit que l'on considère leur fonction vitale ou leur origine histologique, leur ontogénie, leur phylogénie, on s'aperçoit bien vite qu'ils ne sont pas d'importance égale. Il est sans doute plus vrai de dire que les reins existent pour le cerveau que de dire que le cerveau existe pour les reins. Mais peu importe; ils sont vraiment inséparables.

* * *

Toutes nos vues sur l'organisation sociale ont été jusqu'ici brouillées par une antithèse qui semblait ne permettre aucune autre alternative mais qui cependant n'épuisait pas la réalité. On passe de systèmes aristocratiques à des systèmes démocratiques et vice-versa. Les aristocrates maintiennent que certaines classes sociales sont naturellement supérieures aux autres et doivent dominer celles-ci pour le bien général. Les démocrates — et presque toutes nos sociétés modernes sont guidées en principe par des conceptions démocratiques — maintiennent au contraire que les hommes sont essentiellement égaux et qu'ils doivent avoir par conséquent des droits équivalents à la souveraineté collective.

Ces deux théories sont incomplètes et donc inexactes. Il est certain que les hommes sont essentiellement inégaux et que leurs capacités intellectuelles sont très différentes. Ces capacités sont transmises par l'hérédité, mais les lois de l'hérédité sont des lois statistiques; et d'ailleurs l'amphimixie rend l'hérédité humaine si compliquée et si capricieuse qu'on n'en peut prévoir les résultats que d'une manière

très grossière. On ne peut donc dire d'aucune classe qu'elle monopolise certaines capacités intellectuelles à un tel degré qu'elle en acquiert le droit de dominer les autres classes. L'histoire prouve d'ailleurs que les aristocraties dégénèrent. Il y a dans toute société une aristocratie intellectuelle et morale, mais cette aristocratie ne forme pas un groupe défini, tangible et durable. Le personnel du groupe varie lentement mais continuellement, par addition et par soustraction. D'après la conception aristocratique, ce groupe a droit à une série de privilèges et il tend naturellement à s'assurer la possession indéfinie des privilèges conquis. Il doit donc arriver nécessairement que la possession des privilèges survit à celle des qualités intellectuelles et morales qui seules pouvaient les justifier. De là les désharmonies et les injustices fondamentales de tous les systèmes aristocratiques. Les injustices des démocraties ne sont pas moins cruelles; elles sont trop connues pour qu'il y faille insister.

Il semble que le meilleur moyen de sortir de cette impasse, c'est de reconnaître le fait de l'inégalité humaine, l'existence naturelle des élites, mais de leur refuser tout privilège matériel. Le plus grand privilège de tout homme, c'est de servir les autres hommes dans la mesure de ses moyens. Le privilège du rossignol est de chanter mieux que les autres oiseaux et c'est là aussi toute sa récompense; de même celui de l'artiste est de créer de la beauté que les autres hommes sont impuissants à créer; celui du savant, de dégager la vérité de l'erreur. Le privilège de l'élite est donc simplement celui de rendre de plus grands services, d'accomplir plus complètement la destinée humaine. Elle n'en mérite et ne devrait pas en désirer d'autre; il ne faut même pas que ses services soient récompensés ou reconnus, il suffit déjà de les avoir rendus. Ce privilège est en réalité immense, mais comme il n'est pas de nature à exciter des convoitises, il n'offre aucun danger. L'organisation sociale idéale est celle qui permettrait à chaque individu d'utiliser le mieux possible ses talents ou son génie et ainsi de servir le mieux possible les autres hommes. En un mot, l'aristocratie légitime — et la seule qui le soit — est celle qui est consacrée par des services actuellement rendus et qui n'a d'autre privilège que celui de servir l'humanité et d'accomplir la destinée de celle-ci.

Le paradoxe dont je parlais plus haut, c'est le paradoxe du levain. Il en faut absolument, mais il n'en faut que très peu. Les services les plus élevés, ceux que quelques hommes seulement sont capables de rendre, sont aussi ceux qui sont les moins urgents. La société a absolument besoin de quelques poètes, de quelques artistes, de

quelques savants, de quelques penseurs, sinon elle dégénérerait bien vite et redeviendrait une société purement animale. Mais ce besoin n'est pas immédiat : la cité peut exiler tous les poètes et vivre heureuse; et si les philosophes cessent leur travail, elle en souffrira moins que si les boulangers se mettent en grève. De même un homme court bien moins de danger si son cerveau est momentanément ankylosé par l'ivresse, que si son cœur cesse de battre ou son foie de fonctionner. Au point de vue de la vie quotidienne, la science et l'art sont du luxe, mais c'est ce luxe qui justifie toute notre vie; c'en est à la fois la raison d'être et la gloire.

* * *

Il est évident que certains hommes sont supérieurs, intellectuellement et moralement, à d'autres, mais dans la plupart des cas il est difficile sinon impossible de mesurer cette différence. Et du reste, il vaut mieux laisser ces comparaisons à d'autres et surtout éviter de nous comparer nous-mêmes à nos voisins. Consacrons-nous plutôt à extraire de notre être tout ce qu'il contient de meilleur et à en tirer parti pour servir l'humanité le mieux possible. Il y a beaucoup de chances pour que ceux qui se croient grands ne le soient pas. Les personnalités médiocres essayent de s'affirmer et de s'imposer par la critique d'autrui; il vaut mieux s'affirmer par sa propre activité, — positivement et non négativement; il vaut mieux s'affirmer indirectement par la valeur même de son travail sans y ajouter de commentaires, — implicitement plutôt qu'explicitement. L'intolérance est toujours un signe de médiocrité et d'inintelligence; une preuve d'inquiétude et d'erreur. La tolérance n'est pas seulement un devoir mais une loi de vie.

La mission suprême de l'historien, et surtout de l'historien de la science, c'est d'augmenter la tolérance intellectuelle et ainsi d'adoucir la vie, et de rendre plus fécond l'héroïsme de l'élite.

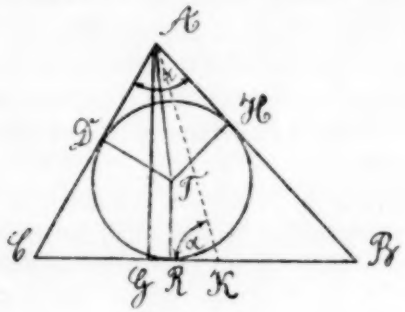
GEORGE SARTON.

Bruxelles, juillet 1925.

Behandlung einiger geometrischen Fragepunkte durch muslimische Mathematiker

1) Das arabische Ms. Seld. Arch. A 32 der Bodleian Library (Oxford) enthält auf den Folia 130-134 eine Studie des bekannten arabischen Gelehrten Ibn al-Haitham (965-1039), des Alhazen des Abendlandes. Sie hat die Aufgabe zum Gegenstand : *die zwei Seiten eines Dreiecks einzeln zu finden, wenn deren Summe gegeben ist und dazu die dritte Seite und der Flächeninhalt des Dreiecks.* Der arabische Autor gibt mehrere Lösungen des Theorems, welches also zu seiner Zeit eine Rolle gespielt haben muss. Leider konnte ich das erstmalige oder ein früheres Auftreten der Aufgabe in der Geschichte der Mathematik nicht feststellen. In der modernen Literatur wird sie von K. Schwering behandelt. (1)

a) Der Autor sagt : Von dem Dreieck ABC ist der Inhalt (al-qadr), die Seite BC und die Summe der beiden Seiten BA + AC bekannt; gesucht ist jede einzelne der beiden letzteren Seiten. Wir konstruieren den Inkreis DHR des Dreiecks mit dem Mittelpunkt T und ziehen die



Figur 1

Radien TH, TD und TR nach den Berührungspunkten. Sie stehen senkrecht auf den Seiten des Dreiecks und sind sich gleich. Es ist nun das Produkt

TH. ½ Umfang des Dreiecks bekannt,

(1) 100 Aufgaben der niederen Geometrie, Freiburg i. Br., 1891 S. 78 ff. Hier wird als Ort der Spitzen der Dreiecke eine Ellipse gefunden.

da dies Produkt gleich der Dreiecksfläche (= Δ), und diese bekannt ist. Ebenso ist der halbe Umfang (= ½ u) bekannt, da der ganze gegeben ist. Somit ist der Kreisradius TH bekannt. Diese Lote (TH, TD, TR) machen, da zu ihrer Konstruktion die Winkel des Dreiecks halbiert worden sind, auf zwei zusammenstossenden Seiten jeweils gleiche Abschnitte, so dass z. B auch BC + AH = ½ u ist. Somit ist BC + AH bekannt, und da BC gegeben ist, ist auch AH bekannt. Und so ist auch das Verhältnis

AH : HT bekannt.

Ziehen wir die Strecke AT, so ist das Dreieck AHT der Gestalt (Form) nach gegeben (d. h. seine Winkel sind bekannt). Es ist nämlich ∢ AHT ein Rechter, und ∢ HAT = ∢ DAT, mithin ∢ BAC bekannt (= ∢ α). Wir fällen von A das Lot AG, welches bekannt ist, da ½ BC. AG = Δ, wo Δ bekannt. Hierauf ziehen wir die Strecke AK so, dass ∢ AKC = ∢ BAC wird. Es ist Δ AKG der Form nach bekannt, d. h. es ist GA : AK bekannt. Somit ist auch AK bekannt. Aus

$$AC.\ AB.\ \sin\alpha = AK.\ KC.\ \sin\alpha + AK.\ KB.\ \sin\alpha$$

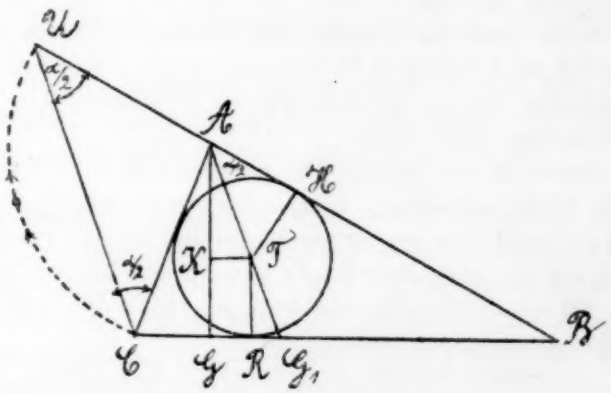
folgt

$$AC.\ AB = AK.\ CB,$$

und dies Produkt ist bekannt. Da nun sowohl

BA + AC, als auch AB. AC bekannt sind, so findet man hiermit BA und AC einzeln. (2)

b) *Andere Lösung des Autors* : Wir zeichnen wiederum das



Figur 2

Dreieck, den Inkreis und fällen das Lot AG, welches bekannt ist. Durch den Kreismittelpunkt T ziehen wir TK ∥ BC. Da GK = TR

(2) Die zur Berechnung einer der beiden Unbekannten resultierende quadratische Gleichung verfolgt der Autor nicht weiter.

bekannt ist, so ist es auch AK = AG — TR. Aus dem Dreieck ATH ist AT bekannt und durch das Verhältnis AT : AK der Figur nach auch das Dreieck ATK ; somit ist auch ∢ TAK bekannt und hierdurch auch ∢ TAB und ∢ GAB. Da der Winkel bei G ein Rechter ist, so ist auch ∢ B (= β) gegeben und damit das Dreieck ABG der Form nach bekannt. Aus dem bekannten Verhältnis BA : AG wird auch BA bekannt; somit ist auch AC bekannt; desgleichen ∢ C, da ja ∢ A und ∢ B bekannt sind. Damit ist das Dreieck ACG der Figur nach bekannt. Und es ist BA : AC (= sin C : sin B) bekannt. Und da die Summe BA + AC bekannt ist, so sind BA und AC einzeln bekannt.

c) *Andere Lösung des Autors* : Nach Zeichnung des Dreiecks und Inkreises verlängern wir AB geradlinig und machen AU = AC (Fig. 2). Wir ziehen AT bis G_1, dann ist $AG_1 \parallel UC$, da ∢ $BAG_1 = \frac{1}{2}$ ∢ BAC und ∢ $AUC = \frac{1}{2}$ ∢ BAC. Und ∢ BUC ist bekannt, da ∢ BAC bekannt ist. Und das Verhältnis BU : BC ist bekannt, da beide Strecken bekannt. Also ist das Dreieck BUC der Gestalt nach bekannt, und BU : CU bekannt, also UC bekannt und Dreieck AUC der Form nach bekannt. Damit UC : AC bekannt und hieraus AC bekannt, womit auch AB gefunden ist.

d) *Andere Lösung des Autors* :

Da das Dreieck BAC bekannt ist, so ist auch der Quotient

$$\frac{BA.\ AC}{\Delta\ ABC}$$ bebannt. (3)

Und da der Inhalt des Dreiecks ABC bekannt ist, so ist auch das Produkt BA. AC bekannt. In Verbindung mit der gegebenen Summe BA + AC wird jede einzelne Seite BA und AC bekannt.

e) *Lösung auf andere Weise* :

Wir denken uns das Dreieck ABC gezeichnet und um dasselbe den Umkreis ABCD beschrieben. Dann teilen wir arc BDC im Punkte D in zwei gleiche Hälften und ziehen die Verbindungslinie DAH. Von A und D fällen wir auf die Seite BC die Lote AG und DZ. Nun gilt :

AB : BH = AC : CH (4), oder auch AB : AC = BH : CH, woraus durch Zusammensetzung (tarkib) folgt :

(AB + AC) : AC = (BH + CH) : CH, oder
(AB + AC) : BC = AC : CH.

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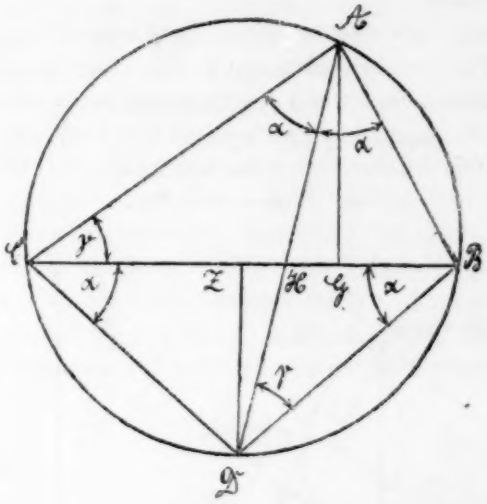
(3) Er ist = 2 : sin α.

(4) Es ist nach dem Sinussatz AB : BH = sin H : sin α, und ebenso AC : CH = sin (180° — H) : sin α.

Das Verhältnis linker Hand ist bekannt, also ist auch AC : CH, und dadurch auch AB : BH bekannt. Es ist ferner :

$$\Delta ABD \sim \Delta HBD \sim \Delta AHC$$

Daraus folgt : $AD : DB = BD : DH = AB : BH.$



Figur 3

Und da letzteres Verhältnis bekannt ist, so ist auch AD : DB und BD : DH bekannt. Ebenso ist AG bekannt, da $AG \cdot BC = 2 \cdot \Delta ABC$ und die Fläche von ΔABC bekannt ist. Da $DZ \parallel AG$, so gilt :

$$AG : DZ = AH : HD.$$

Letzteres Verhältnis ist bekannt (5), also wird DZ bekannt. Die Seite BC wird durch das Lot DZ halbiert, also ist auch BZ bekannt. Ferner ist jetzt im rechtwinkligen Dreieck BDZ die Hypotenuse BD bekannt. Und da nach Früherem das Verhältnis AD : DB kekannt ist, so kennt man auch AD selbst und mittels Kenntnis des Verhältnisses AH : AD jede einzelne dieser beiden Strecken. Aus

$$AB : HD = AH : HC$$

findet man einzeln die Grössen HB und HC (6). Also ist das Produkt BH. HC bekannt. Und da die Verhältnisse

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(5) Es ist nämlich AC : CH bekannt und ebenso AB : BH. Und aus der Figur 3 liest man ab : CH : BH = AH : HD.

(6) Es ist ja HC = BC — HB.

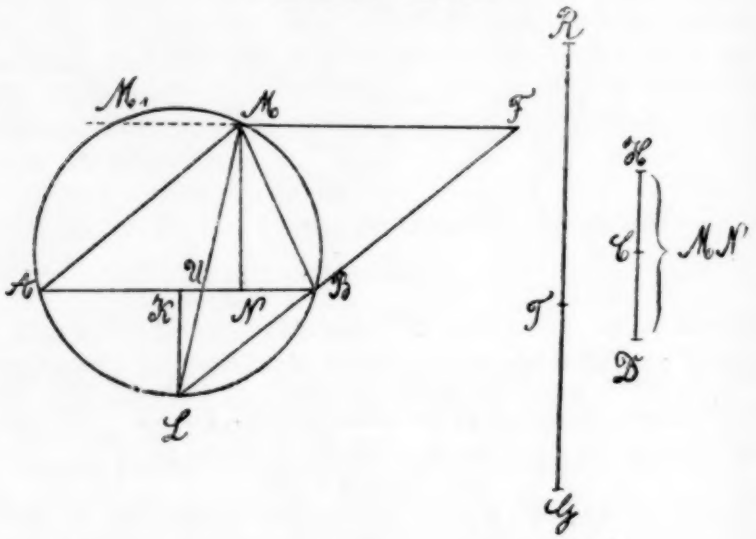
AB : BH und AC : CH einzeln bekannt (einander gleich) sind, so ist auch das Produkt der beiden Verhältnisse

$$\frac{AB \cdot AC}{BH \cdot HC}$$

bekannt. Somit findet man aus AB. AC und AB + AC die Grössen AB und AC einzeln.

f) Wir wollen jetzt über einer geraden Linie AB ein Dreieck von gegebenem Flächeninhalt zeichnen. Bekannt sei ferner die Summe der beiden anderen Seiten, und die Fläche die dem Inhalt des Dreiecks gleich sein soll, sei gebildet durch die Strecken AB, CD, die Summe der beiden Dreiecksseiten durch die Strecke RG. Wir machen

RG : AB = AB : TG.



Figur 4

Die Strecke AB teilen wir im Punkte K in zwei Hälften. In K errichten wir eine Senkrechte auf AB; sie sei = KL. Dann machen wir CH = CD und das Verhältnis

HD : KL = RT : TG

Wir ziehen AL und BL und beschreiben um das Dreieck ALB den Kreis ALBM.

Wir verlängern LA geradlinig und machen

FA : AL = HD : KL

Durch den so gefundenen Punkt F ziehen wir eine Parallele zu AB. Es sei FM; sie schneide den Kreis in M. Verbinden wir jetzt noch M

mit A und B, so behaupte ich, dass Δ AMB gleich der Fläche ist, welche durch AB, DC (= ½ AB. DH) gebildet wird, und dass AM + MB gleich der Summe der beiden Seiten (= RG) ist.

Beweis. — Wir ziehen LUM und fällen von M auf AB das Lot MN.

Dann gilt : MN : KL = MU : UL = AF : AL

Es ist aber AF : AL = HD : KL, d. h.

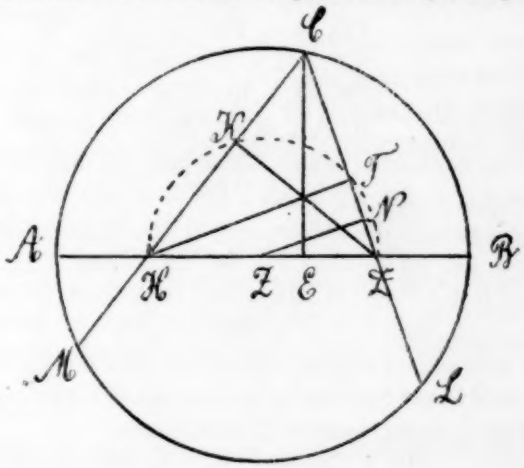
MN : KL = HD : KL

oder MN = HD

Also wird Δ AMB = AB. ½ MN

= AB. CD, q. e. d. (7).

II) In der Kairiner Sammelhandschrift : « Masā'il handasīya mutafarriga » (Diverse geometrische Theoreme), für die kein Verfasser resp. Kompilator zeichnet, findet sich folgender planimetrische Lehrsatz von IBN AL-HAITHAM ausgesprochen und bewiesen : *Es sagt* 'ALĪ ḤASAN IBN ḤUSAIN AL-BAṢRĪ (8) : *Wenn wir auf dem Durchmesser eines Kreises zwei Punkte in gleicher Entfernung vom Kreis-*



Figur 5

mittelpunkte annehmen, und wir ziehen durch sie zwei gerade Linien, die sich auf dem Umfang des Kreises schneiden, siehe, so ist die Summe der Quadrate dieser beiden Strecken gleich der Summe der Quadrate der Teile des Durchmessers.

(7) Der Autor schliesst hier noch ausführliche Determinationen an.

(8) So öfters sein Name, da er ursprünglich in Baṣra lebte; erst später wanderte er auf Veranlassung des Kalifen AL-ḤĀKIM nach Kairo aus, wo er bis zu einem Tode blieb.

Es sei der in Rede stehende Kreis ABC, sein Durchmesser AB und sein Mittelpunkt Z. Auf AB nehmen wir die zwei von Z gleichabständigen Punkte D und H an. Durch sie ziehen wir die beiden Sehnen LDC und MHC, und ich behaupte, dass alsdann

$$DC^2 + HC^2 = BD^2 + DA^2$$

ist.

Beweis : Wir beschreiben über DH als Durchmesser den Halbkreis HKTD, ziehen DK und HT und machen CE ⊥ AB. Dann verlängern wir CD und CH bis L, resp. M. Aus dem Kreismittelpunkt Z fällen wir auf CL den Perpendikel ZN, und da DTLH ein Halbkreis ist, so ist ∢ DTH ein Rechter, somit auch ∢ HTC ein Rechter, und ∢ CEH ist ebenfalls ein Rechter. Und nun gilt :

$$CD.\ TD = HD.\ ED \qquad (\text{da } TD : HD = ED : CD),$$

und ebenso ist : $CH.\ HK = DH.\ HE.$

Die Addition beider Zeilen ergibt :

$$CD.\ DT + CH.\ HK = DH^2 \ldots\ldots\ldots 1)$$

Ferner bestehen die Gleichheiten : $LN = CN$; $DN = TN$; $DL = TC$.

Da ferner $CD.\ DL = CD.\ CT$

und $CD \cdot DL = BD.\ AD,$

so ist auch : $CD.\ CT = BD \cdot AD$

Sodann ist $HC.\ CK = AH.\ HB.$

Durch Addition der beiden letzten Zeilen gewinnt man :

$$DC.\ CT + CH.\ CK = BD.\ AD + AH\ .\ HB = 2.\ AD.\ AH. \ldots\ldots 2)$$

Addieren wir nunmehr die Gleichungen 1) und 2), so erhalten wir :

$$CD\ .\ TD + HC.\ HK + DC.\ CT + HC.\ CK = DH^2 + 2.\ AD.\ AH,$$

oder : $CD.\,(TD + CT) + CH.\,(HK + CK) = (AH - AD)^2 + 2.\ AD.AH,$

oder : $CD^2 + CH^2 = BD^2 + AD^2$ q. e. d.

Wie man erkennt, ist die Seitenhalbierende CZ nicht in Betracht gezogen, so dass dieser Satz des Ibn al-Haitham sich formell nicht mit jenem des Pappos deckt, welcher die Gleichheit

$$CD^2 + CH^2 = 2.\ (CZ^2 + DZ^2)$$

beweist. (S. Fr. Hultsch : Pappi Alexandrini Collectionis liber VII, Propos. 122. pag. 858-59). Aber es ist anzunehmen, dass dem muslimischen Gelehrten genannte Propositio des Pappos bekannt war.

III) Um den Ausbau der *Trigonometrie* haben sich die Araber besonders verdient gemacht. Dies darf nicht Wunder nehmen, waren doch ihre astronomisch-astrologischen und religiösen Praktiken ganz in der Linie der sphärischen Trigonometrie gelegen. Aber nicht nur diese erleichternden Tafeln (zijāt) erstellten sie für die geographische

Breite aller wissenschaftlichen Brennpunkte des islamischen Kulturbereichs, sondern förderten die Trigonometrie auch in ihrem theoretischen Teil. Als ihr eigenstes Verdienst können sie z. B. die Aufstellung (und den Beweis) des sphärischen (und auch ebenen) *Sinus-Satzes* buchen. Welcher arabische Mathematiker oder Astronom ihn zuerst aussprach und bewies, ist bis jetzt noch nicht ausgemacht; aus der zweiten Hälfte des 10 Jahrhunderts lässt sich seine Kenntnis bei mehreren arabischen Autoren nachweisen. So hat H. SUTER festgestellt, dass ihn der ums Jahr 1000 verstorbene ABŪ NAṢR IBN 'IRĀQ, der Lehrer AL-BIRUNĪ's, gekannt (9), ferner begegnet er uns bei ABU'L-WAFĀ' († 998) (10), bei ABŪ MUH. AL-KHUJENDĪ († ca 1000) (11), IBN YŪNUS († 1009) (12) und AL-BĪRŪNĪ († 1048) (13). Nach dem Bericht des NAṢĪR AD-DĪN AṬ-ṬŪSĪ († 1274) fände sich unser Satz sogar schon bei AN-NAIRĪZĪ († 922/23), in dessen Kommentar zu dem Almagest des PTOLEMAIOS (14). Aber in der Abhandlung des NAIRĪZĪ « Ueber die Richtung der Qibla » (15) findet er sich nicht erwähnt, obwohl dies Schriftchen naturgemäss ganz in das Gebiet der sphärischen Trigonometrie einschlägt.

Hier möchte ich den Originalbeweis des schon genannten AL-KHUJENDĪ vorführen, wie ich ihn in dem erwähnten Kairiner Schriftchen fand (Masā'il handasīya etc.). Er zeichnet sich gegenüber jenem desselben Autors, den NAṢĪR AD-DĪN AṬ-ṬŪSĪ anführt, durch grössere Vollständigkeit aus. Der Autor sagt :

Zwei Grosskreise mögen sich auf der Kugeloberfläche unter einem beliebigen Winkel schneiden, und ich nehme auf jedem der beiden Kreise 2 Bögen an, wie die Figur es darstellt. Und ich behaupte, *dass das Verhältnis des Sinus eines jeden der Bögen zum Sinus der Neigung mit dem anderen der 2 Kreise gleich ist dem Verhältnis des Sinus eines*

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(9) Zur Trigonometrie der Araber (*Biblioth. Mathemat.*, 3. Folge 10. Bd. 1910, S. 156-160).

(10) Vgl. CARRA DE VAUX : L'almageste d'ABŪ'L-WÉFA ALBUZDJĀNĪ (*Journ. asiat.* 1892, p. 423).

(11) Vgl. ALEX. CARATHEODORY : Traité du Quadrilatère attribué à NASSIR UDDIN EL TOUSSY, (Constantinople 1891, p. 151).

(12) C. SCHOY : Gnomonik der Araber. Berlin 1923, S. 37.

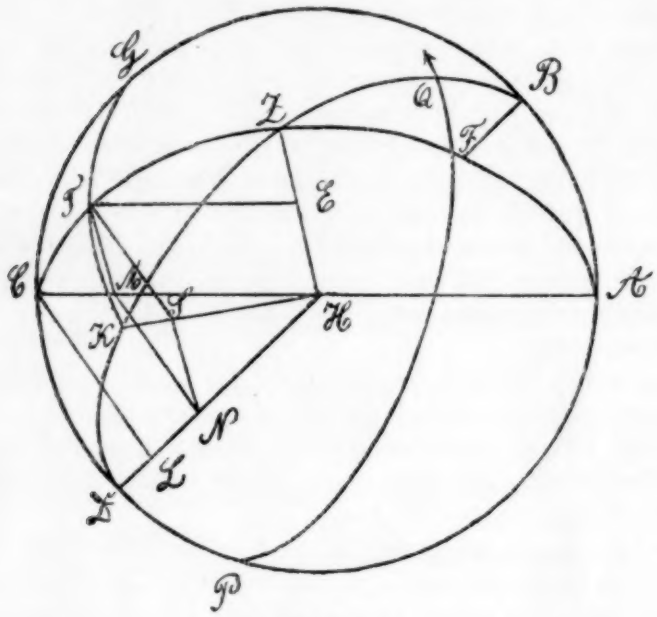
(13) Al-qānūn al-Mas'ūdī (Berl. arab. Ms. okt. 275 S. 81[a]).

(14) Traité du Quadrilatère, etc., p. 150.

(15) Vgl. C. SCHOY in den *Sitzungsber. der bayer. Akademie d. Wissensch.*, (mathem.-physikal. Klasse, 1922, S. 55/69).

anderen beliebigen Bogens dieses Kreises zum Sinus der Neigung (mail) mit jenem Kreise.

Es sei ABCD der Kreis der Zeichnungsebene mit dem Mittelpunkt H. Ueber ihm erheben sich scheitelrecht zur Ebene ABCD die 2 Grosskreise AZC und BZB. Sie mögen sich in Z unter einem beliebigen Winkel schneiden. Ich nehme von Z aus auf dem Kreise AZC die



Figur 6

Bögen ZT, ZC und ZF an. Durch den Punkt T lege ich einen grössten Halbkreis, der den Kreis BZD unter einen rechten Winkel schneidet. Es sei dies der Kreis GTK. Ein zweiter Halbkreis, nämlich HFQ gehe durch den Punkt F und treffe den Kreis BZD ebenfalls rechtwinklig. Und nun behaupte ich dass

$$\frac{\sin ZT}{\sin TK} = \frac{\sin ZC}{\sin CD} = \frac{\sin ZF}{\sin FQ.}$$

Beweis : Wir ziehen die beiden Durchmesser AC und BD, die sich im Punkte H schneiden mögen. Es ist AC gemeinschaftlicher Ausschnitt der 2 Kreisebenen ABCD und AZC und BC dasselbe für die Ebenen ABCD und BZD. Ziehen wir noch HK, so ist es eine den beiden Flächen BZD, GTK gemeinschaftlich angehörige Strecke. Auf die

Geraden AC, BD, ZH, KH fällen wir resp. die Lote TM, SN, ET und TS; endlich ziehen wir noch CL ⊥ RD und verbinden MN. Und da nun die 2 Kreisflächen AZC und BZD senkrecht auf der Ebene ABCD stehen, so ist auch ZH ⊥ ABCD, und so sind TM und ST ⊥ ABCD, da beide auf den gemeinschaftlichen Ausschnitten senkrecht stehen. Es werden ebenso TS und CL senkrecht zur Ebene BZD stehen, d. h. die beiden Lote ZH und TM sind parallel und MH liegt in beiden Flächen. Es sind die Winkel ZHM, TMH, HET jeweils = 90°; somit bleibt : ∢ ETM = 90°; mithin ist die Fläche HMTE ein rechtwinkliges Parallelogramm. Es ist nun

$$TE = MH = \sin TZ$$

Und wahrlich, die 2 Lote TM und SN sind parallel, und die Strecke MN liegt in ihrer beiden Fläche. Und ∢ TMN = ∢ SNM = 90°. Aber auch ∢ TMN ist 90°, und somit verbleibt auch für ∢ STM 90° ; mithin ist die Fläche TMNS ein rechtwinkliges Parallelogramm. Ferner ist

$$TS = MN = \sin TK,$$

und da TS ∥ MN und beide in ein und derselben Fläche liegen, so ist TS ⊥ BZD, also auch MN ⊥ BZD.

Es ist schon erwähnt, dass CL ⊥ BZD, daher MN ∦ CL, also

$$\Delta\, HCL \sim \Delta\, HMN.$$

Es gilt also die Proportion :

$$\frac{HM}{MN} = \frac{HC}{CL}$$

Und da $HM = \sin TZ$; $MN = \sin TK$,

$HC = \sin CZ$; $CL = \sin CD$,

so stehen die Sinus der 4 Bögen in Proportion. Genau so können wir dartun, dass gilt :

$$\frac{\sin TZ}{\sin TK} = \frac{\sin ZF}{\sin FQ}$$

Und das war es, was wir beweisen wollten.

(*Essen a. d. R.*) C. Schoy.

The manuscript text of the Cyrurgia of Leonard of Bertipaglia.

Numerous important differences exist between the text of the work on surgery of LEONARD OF BERTIPAGLIA as given in such printed editions of it as I have been able to see, and the text as presented in two fifteenth century manuscripts. One of these manuscripts, now contained in the Laurentian Library at Florence, is a copy of LEONARD'S work made in 1471 (1) the other manuscript is found in the Sloane collection of manuscripts in the British Museum, London (2), and may possibly date from 1421. It seems, however, to me to be a copy and not LEONARD'S autograph. It seems evident from their variations that neither manuscript is copied from the other; in fact, as we shall see, one may represent LEONARD'S lectures as delivered in the year 1421 and the other as given in 1424. Yet they seem to give essentially the same text. The three printed editions which I have seen also are essentially identical. The striking divergences are between the printed and the manuscript texts. The editors have done much to render LEONARD'S work colorless and drab by omitting personal remarks and observations and clinical cases, and on the other hand have added much matter that is obviously spurious to his treatise.

LEONARDO DA BERTAPAGLIA has perhaps been hitherto the most commonly received form for LEONARD'S name, but Bertapaglia was probably the same as the modern Bertipaglia, a small place a little to the south of Padua. The manuscripts give the name as LEONARDUS DE BERTAPALLIA (3), BERTEPALLIA (4), BERTAPALIA (5), or BERTA-

(1) Cod. Bisconiani 13, fols. 1-68v.

(2) Sloane 3863, fols. 1-110v.

(3) Sloane 3863, « Hec sunt recepte date per mag. L. DE BERTAPALLIA a. d. 1421 suis sociis... »

(4) *Ibid.* « Cyrurgia mag. LEONARDI DE BERTEPALLIA. »

(5) Bisconiani 13, fol. 1, « Hec sunt recepte date per magistrum LEONARDUM DE BERTAPALIA... »

PALEA (6). As the Explicits of both manuscripts inform us, LEONARD was professor of surgery (7), and as the full form of title or the sub-title near the beginning of both manuscripts informs us, he gave his treatise in the form of lectures on the third, fourth, and fifth Fen of the fourth Canon of AVICENNA at the University of Padua, where, as the Sloane manuscript further informs us, he was deputed to lecture on surgery by the Venetian government (8). In the manuscripts, however, he addresses the work to his son. The Sloane manuscript states that the lectures were given or the work published in 1421. The other manuscript gives an illegible date in one place and the date 1424 in its *Explicit* as the date of composition. It is possible that the date 1421 should apply to the main body of the work, and the date 1424 to the closing *Tractatus de iudiciis* or *De aspectibus*, which appears to bear no relation to the text of AVICENNA and to be in the nature of a supplementary and well-nigh separate treatise on the theme of astrological medicine and surgery (9). In the printed editions a passage which is evidently

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(6) Biscon. 13, fol. 68v, « Expletum est hoc opus compositum padue anno 1424 per Excellentissimum professorem cirurgie magistrum LEONARDUM DE BERTAPALEA... ».

(7) Sloane 3863, fol. 109r, Rubric, « Explicit cirurgia compilatum per magistrum LEONARDUM DE BERTEPALIA excellentissimum professorem cirurgie... ». See preceding note for the *Explicit* of the other MS.

(8) It follows the prologue on the first leaf of either MS. In Sloane 3863 it reads : « Hec sunt recepte date per mag. L. DE BERTAPALLIA a. d. 1421 suis sociis ; qui deputatus fuit ad lecturam cirurgie per rectores ducalis dominii Venetorum in studio Paduano et hoc super terciam et quartam et quintam fen quarti canonis ». In Biscon. 13, it runs : « Hec sunt recepte date per magistrum LEONARDUM DE BERTAPALIA anno domini mille ... (characters that I could not make out) in studio paduano et habet super tertium quartam et quintam fen quarti canonis AVICENE ».

(9) In Biscon. 13, fol, 68v, the *Explicit* given in note 6 above is immediately preceded by the following *Explicit* for the astrological treatise, « Sit ergo gratia brevitatis nunc finis huic tractatu de aspectibus compillatum et in hac forma abbreviationis deductum per LEONARDUM DE BERTAPALEA paduanum anno mill. CCCCo. XXIIIIo. de mense martii ». Perhaps this should read : « anno mill. CCCCo. XXIo. IIIo. die mense Martii » (March 3, 1421). We could then explain away the figure 1424 in the second *Explicit* as based upon this misreading. In the Sloane MS, fol. 109r, the word *deductum* is immediately followed by the *Explicit* of the entire work, « Explicit cirurgia... » as already given in note 7 above.

not by LEONARD speaks of him as present at an « anatomy » performed near Padua in 1429 and as then still lecturer in surgery at the university. The assertion of GURLT (10) that he attended another dissection « de matrice in muliere » in 1440 probably has as its sole basis the mention in the same passage of another « anatomy » (de matrice in muliere) in 1430, but nothing is said of LEONARD's being present thereat.

LEONARD's work is said to have been printed at Venice in 1490 and 1497 with the title, *Chirurgia sive recollecta super quartum canonis Avicennae* (11), and again in 1498, 1499, 1519, and 1546, all at Venice — with editions of GUY DE CHAULIAC and other surgical treatises. I have been able to examine the editions of 1498, 1499, and 1546, where the work is headed, « Recollecte habite super quarto AVICENNE ab egregio et singulari doctore magistro LEONARDO BERTAPALIA ». Of the editions of 1490 and 1497 I have found little trace; they are not contained in the British Museum, Bibliothèque Nationale, or National Library at Florence, and are not recorded in HAIN's *Repertorium bibliographicum* and its various supplements or in any other catalogue of incunabula that I have seen. The edition of 1519 is contained in the Library of Congress, where it has been examined for me. The surgical collection of 1546 contains, preceding its tables of contents, an introductory note or advertisement by its editor or publisher which is not found in the editions of 1498, 1499 and 1519. In addition to claiming to have improved the text of GUY OF CHAULIAC over previous editions, to have substituted the *Surgery* of ROGER for his *Physica* given in previous editions, and to have added a completer version of WILLIAM OF SALICETO's *Chirurgia*, the note boasts of having made very considerable additions and emendations to the next of BERTAPALIA from a manuscript (12). As a matter of fact, in so far as I have compared them, the 1546 text of LEONARD's treatise is identical with that contained in the 1498, 1499 and 1519 collections of surgical treatises. This warns us how little faith is to be placed

(10) E. GURLT, *Gesch. d. Chirurgie*, Berlin, 1898, I, 858.

(11) GURLT, who repeated this information after MAZZUCHELLI, *Gli scrittor d'Italia*, II, ii, 1032, (Brescia, 1760), himself used only the edition of 1498 in his analysis of the work's contents.

(12) « Idem in BERTAPALIA fecimus quippe qui integras paginas interdum adiunximus ex manuscripto codice tum simul plurimis in locis non raro quidem quatuor vel quinque versus sæpius vero integras sententias ac dictiones addi dimus plerunque etiam ipsas emendavimus ».

in these advertisements or « blurbs » of the early printers, whose main object was of course to sell copies of their particular edition rather than to contribute accurate data for the history of textual criticism. This note or advertisement is not found in the 1498, 1499 and 1519 editions. Furthermore, the 1498 and 1519 editions (and I think also the 1499 edition) contain ROGER's *Physica* rather than his *Surgery*, and do not include WILLIAM OF SALICETO at all. There is therefore a certain amount of truth in the later note or advertisement. Consequently, although its boast of additions to LEONARD OF BERTIPAGLIA's text does not seem justified so far as the text of the editions of 1498, 1499 and 1519 are concerned, it may have some truth with reference to the earlier editions of 1490 and 1497 (if indeed there were any such editions). Or at least we seem justified in assuming that it would be very unlikely that the text of the 1490 and 1497 editions (assuming their reality) contained the passages found in our two manuscripts and omitted in the later editions. The later editions from 1498 on may possibly, however, have been the first to add the spurious matter which should not be attributed to LEONARD OF BERTIPAGLIA.

One of our manuscripts has also undergone certain vicissitudes, not however of its text, but in the matter of binding and pagination. In the old catalogue of the Sloane manuscripts, written out in long hand in several thick volumes, of which the only copy is that preserved in the general reading room of the British Museum, there being no fellow to it in the Manuscript Room for Students, the work of LEONARD OF BERTIPAGLIA is described as covering only fols. 1-100, and as followed on fol. 100v by an « Aque caustice magistri PETRI DE TOSSIGNANO », and at fols, 101-110 by a fragment of a book on wounds of the head. In reality this third item is a portion of LEONARD's own treatment of the fifth Fen of AVICENNA, and has, since the time when the old manuscript catalogue was compiled, been rebound and the leaves renumbered so that they now constitute fols. 91-100, while the former fols. 91-100 are now last in the manuscript and numbered 101-110. This brings the conclusion and table of contents of LEONARD's work where they belong at the close of the manuscript, followed only by the brief note concerning the Caustic Waters of PETER OF TOSSIGNANO which some one has added in the blank space on the last leaf. But, whether it be that the recent rebinding merely failed to note and rectify a further mis-arrangement of the leaves of the codex that was already in existence

when the old catalogue was drawn up, or whether in transposing the last two decades of folios the earlier ones were accidentally disturbed from their previous and proper order, at any rate the leaves from fol. 11 to fol. 90 are now bound and numbered in wrong order and should be read in the following sequence : following fols. 1-10 should come fols. 71-90, then fols. 51-60, then fols. 41-50, then fols. 11-40, followed in their turn by fols. 91-110 as now numbered (13). This Sloane manuscript presents LEONARD's text in a double-columned page with ample margins.

We have already alluded to the relation which the work of LEONARD bears to the fourth Canon of AVICENNA, but it seems to be less a commentary upon the text of AVICENNA than a collection of recipes (as it is described in the sub-titles of both our manuscripts), cures, unguents, plasters, and some of LEONARD's own clinical experiences. He roughly adheres to the order and main topics of the third and fourth Fen, but in the case of the fifth Fen, he seems to pass over AVICENNA's first two *tractatus* and deal only with the subject of the first chapter of AVICENNA's third tractate, *De fractura cranei*. Then LEONARD's concluding astrological treatise or treatises or chapters seem to have nothing to do with AVICENNA whatever.

The division of LEONARD's work into treatises and chapters, and the presence or absence of rubrics and headings, varies considerably, as is apt to be the case, in the printed text and our two manuscripts. At the close of this paper I reproduce the table of contents given at the close of the Sloane manuscript. Its first treatise under the third Fen deals with hot apostemata, as does the corresponding treatise of AVICENNA, but the manuscript has only 13 chapters where AVICENNA has 34 (14). Its second treatise under the third Fen deals with cold apostemata, like AVICENNA's second treatise, but has only 12 chapters against his 22. The printed text in the 1498 edition combines these two treatises into a single one of 27 chapters. AVICENNA's third tractate under the third Fen, treating *De lepra* in three chapters, finds no parallel in LEONARD's text,

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(13) I called this to the attention of the librarian in charge last summer, and a note has now been inserted in the MS giving the correct order of folios.

(14) Thus *De formica* is cap. 6 in AVICENNA, cap. 3 in LEONARD ; *De exituris* is cap. 20 in AVICENNA, cap. 10 in the LEONARD MSS, cap. 12 in the 1498 printed text,

which, however, divides into the same four treatises under the fourth Fen as does AVICENNA, and with but slight variations in the numbers of chapters. Here again the printed text combines the first two of these treatises into a single one of 20 chapters. So far then, for the third and fourth Fen, we have six treatises indicated in the Sloane manuscript and four in the printed text. The transition from the third to the fourth Fen had been indicated in both our manuscripts but not in the printed text; that from the fourth to the fifth Fen passes unmarked in both manuscripts and printed text. In the printed editions the next treatise that we encounter is headed, *Tractatus quintus de egritudinibus que accidunt in ossibus*, and its first chapter corresponds to that at fol. 35r of the Sloane MS., *De ventositate spine*, etc. But there seems to be no support in the manuscripts for commencing another treatise at this point. They rather point to the heading *De fractura capitis* which occurs a few leaves later (fol. 39r in the Sloane MS; fol. 56v in Bisconiani 13) as the opening chapter of a treatise *De fractura cranei*. The printed editions next distinguish a sixth treatise *De iudiciis vulnerum*, etc., but the Sloane manuscript appears to divide this astrological matter into two treatises. The printed editions then add a seventh treatise, *De antidotis*, which is not contained in the manuscripts at all and of which we shall say more presently. Leaving it out of account, we find that the Sloane manuscript distinguishes nine treatises, while the printed editions divide the same extent of text into only six treatises. The catalogue of the Bisconiani manuscripts even describes our work as only four treatises in medicine or surgery, perhaps because the only beginnings of treatises that are clearly marked in that manuscript (Biscon. 13) are those of the second, third, and fourth treatises under the fourth Fen, occurring at fols, 27v, 35v, and 49r respectively (15).

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(15) The astrological section of LEONARD's work is apparently not counted as one of the four treatises. In the descriptive title, « Tractatus Chirurgicus seu Recepte date per magistrum LEONARDUM DE BERTAPALEA Paduano (*sic*) in studio eiusdem civitatis super tertiam, quartam, et quintam Fen. quarti canonis AVICENNE; necnon Tractatus de signis celestibus et planetis, » I am not sure whether the last clause is meant to apply to the last and astrological section of LEONARD's work, which would thus seem to be considered a separate treatise from his work on AVICENNA, or to apply to the astrological work of the PSEUDO-HIPPOCRATES which follows in the MS at fol. 69.

The divergence between the manuscript and printed text of LEONARD's work is noticeable in their very opening words which introduce two prologues that are quite different both in wording and in length, that of the manuscripts being twice as long as the other. At the same time they express somewhat similar ideas and in part cover the same ground, so that it would seem impossible and inconceivable that they constitute two sections of one prologue. Therefore, either one of them is not genuine but concocted by some editor, or possibly LEONARD himself issued two versions of his work, corresponding it might be to the varying manner in which he lectured on the subject in different years at the University of Padua. However, against this hypothesis it may be noted that although our two manuscripts seem to suggest two different dates, 1421 and 1424, for LEONARD's lectures, they both present the same prologue. As for the divergence between this prologue and the shorter one given in the editions, both implore divine aid but in quite different terms, and while the printed prologue refers briefly to LEONARD's own experiments, the manuscript prologue tells of another man who was ignorant of the art of surgery but who made much money and reputation as a physician from a single « experiment » or cure of LEONARD's, until he became puffed up with vain glory and an object of vituperation for other scientific medical men. But the divergence between the two prologues may be best shown by reproducing the Latin text of both at the close of this paper.

The printed editions seem clearly in error in adding a seventh part or treatise, *De antidotis*, which does not appear in either of our manuscripts, and which apparently consists of miscellaneous recipes which some student or practitioner has added at the close of his copy of LEONARD's work. This is indicated by several circumstances. In giving the title of the entire work, « These are the *Recollectae* held over the fourth of AVICENNA by the outstanding and singular doctor, master LEONARD BERTAPALIA », the heading in the printed editions adds, « and here are marvelous secrets possessed by him and tested (or, experienced) by me » (16). That is to say, some later person has added his own medical experiences to those of LEONARD. Secondly, the whole general character of this concluding treatise, *On Antidotes*, is very miscellaneous, suggesting a scrap-book, or occasional jottings and notes, rather than a consecutive treatise.

(16) « . . . et ibi sunt mirabilia secreta habita ab eo et per me experta. »

For instance, besides cures by HUGH OF SIENA (16a) for dropsy and a cough, and various other recipes, we find a few notes on the significance of different colors of urine, and eight verses listing a number of surgical instruments. Third, in one particular passage dated 1429, whereas LEONARD's work as a whole is dated 1424, we read that on the eighth of February of that year an anatomy was performed on the body of a robber and murderer of Bergamo « by the outstanding and singular doctor, master HUGH OF SIENA, lecturer here in ordinary (17), in the morning in a house near St. Luke's in Paduan territory; and I was present at it with master LEONARD, lecturer in surgery... » The writer, evidently a third person and presumably a pupil or possibly a colleague of HUGH and LEONARD, then goes on to record another anatomy held in 1430 (18).

But the most striking and important discrepancy between the manuscript and printed texts of LEONARD's work is the presence of

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(16a) HUGH was famous as a philosopher as well as « medicorum princeps ». AENEAS SYLVIUS tells (cap. 52. Europæ) how he invited the Greeks at the Council of Ferrara to a banquet and disputation over points on which ARISTOTLE and PLATO disagreed. HUGH allowed the Greeks to take either side they pleased and then defeated them. I owe this reference to THEODOR ZWINGER's *Theatrum vitae humanae*, 1604, V. i. 1209.

(17) The reference, of course, is to the distinction made in the schedules of classes in the medieval universities between « ordinary » and « extraordinary » lectures.

(18) The Latin of the entire passage, which is picturesquely circumstantial, is as follows in the edition of 1546 : « Anno Iesu Christu M.CCCC.XXIX. Octava die mensis Februarii facta fuit anotomia de quodam viro Bergomensi qui quendam ut ei subriperet aurum occiderat per egregium et singularem doctorem Magistrum UGONEM de Senis ibi ordinarie ad lecturam deputatum de mane in quadam domo apud Sanctum Lucam in terra Patavina : et ego huic interfui cum Magistro LEONARDO deputato ad lecturam chirurgie, et hoc actum in squadra de Turricellis et inde sepultus fuit ad eandem ecclesiam sancti Lucae qui nos ab hoc tanto casu defendat Rectore M. MARCO. M CCCC XXX in vigilia Ascensionis Domini facta est anotomia de matrice in muliere de mense Aprilis die quarto Rectore Magistro MARCO FUSCARI nobili Veneto. » (Fol. 299v)

It may be translated somewhat as follows: In the year of Jesus Christ 1429, the eighth day of the month of February, an anatomy was performed on a certain man of Bergamo, who had killed somebody in order to steal gold from him, by the outstanding and singular doctor, master HUGH of Siena, deputed here to give ordinary lectures, in the morning in a house near St. Luke's in Paduan territory: and I was there with Master LEONARD, lecturer in surgery, and this took place in the square of Turricelli, and then he was buried at the same church of St. Luke — may he preserve us from such a fate — during the rectorship of

more personal and clinical material in the manuscripts. LEONARD, like so many medieval men who possessed intellectual curiosity and ingenuity or some specialized skill, had a distinct and interesting, albeit somewhat naïve and quaint, personality which he does not hesitate to reveal in his text. He shows a pardonable pride in his own healing powers and surgical skill, a pardonable interest in his own clinical cases, and he has a style of writing of his own, quaint, garrulous, and rather breathless, somewhat defective in point of grammatical correctness and elegance. « Let no one », he remarks in one place, « charge me with prolixity of rude speech because I have said many things complicated by obscurity and confusion » (19). A great deal of unsubstantiated clap-trap has been written about the lack of individuality in the middle ages and the development of individuality as a result of the Italian Renaissance. But the humanists objected to anyone's having a style of his own almost as much as to his writing ungrammatically, and strove to write like the ancients in general and CICERO in particular. At any rate in our particular case the editors and printers of the late fifteenth and early sixteenth centuries have ironed out and suppressed, whether intentionally or accidentally, a number of expressions of LEONARD's individuality and personal scientific experience, so that the printed text fails to gives us a correct and accurate idea of this early fifteenth century work or of the surgery of that time. It is a good single instance of the

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M. MARCUS. 1430 on the eve of the Ascension of our Lord an anatomy was performed on a woman's womb on the fourth day of the month of April during the rectorship of MARCUS FUSCARI, a noble of Venice. »

Possibly « in the morning » should go with « ordinary lectures » rather than indicate the time of the « anatomy ».

The mention of the university in each case may be explained by the fact that it was a common provision in the statutes of the Italian universities in the fourteenth and fifteenth centuries that the corpse for the anatomy should be furnished annually by the local Podestat or other official at the request of the rector, and that no doctor or scholar should acquire any body for purposes of dissection except through the rector. The number of persons permitted to attend an anatomy was limited so that all might obtain a good view — for example, in the Statutes of the University of Ferrara of 1444, to fifty : see BORSETTI, *Historia almi Ferrariae gymnasii*, Ferrara, 1735, I, 431-37, Statutum 60 — and it seems to have been a much sought after privilege.

(19) « Nemo michi crimen imponat ex prolixitate rudis sermonis cum multa complicata obscuritate et confusione dixerim... », Biscon. 13. fol. 27v ; Sloane 3863, fol. 51v. I did not find the passage in the printed editions.

general truth that the early modern period failed to appreciate and misunderstood much in the previous medieval civilization, which has thus hitherto suffered in our estimation from this misinterpretation or neglect.

This failure to reflect LEONARD's personal remarks and clinical observations is especially noticeable in the portion of his work devoted to fracture of the skull. Here he appears to have added to his university lectures some surgical counsels for the benefit of his eleven year old son, FABRICIUS (20). In an introductory passage which does not appear in the printed text he mentions his longing for truth and learning, « being of the opinion that no better thing for men could be perceived in this world. Wherefore before I knew this, I did not know whether it would come from God or from fortune. But in the manual art I never could distinguish a completely unskilled from an unskilled person. » Perhaps the writer of the manuscript has by a slip written *unskilled* twice here where one of the words should be *skilled*. LEONARD continues, « Since many doctors and skilful persons have been deceived, and especially in wounds of the nerves and fractures of the head, wherefore to rehearse as many and as long statements as have been made by the men of old would be tedious to hear and too confusing and not well adapted... to my son FABRICIUS who is eleven years old. Therefore in this my work... I shall follow another method than that followed by my professors, but I shall cite some authorities where they are in my judgment praiseworthy, and I will narrate marvelous works of nature with God's aid and following the method and rules of the ancients. For in this work... I intend to make special chapters concerning each disease treated surgically, beginning first with the head, speaking concerning it theoretically. Secondly, treating of it practically and giving the best examples. And this according to my own opinion put in the form of a counsel according to cases I have had under cure and have seen in the city of Padua, Rome, Verona, Venice, in Alexandria, in that city in which MOHAMMED is worshipped as a god by the Saracens in Mecca. But I swear by the living God and truly crucified to make no false statement to you, my son, in this my book to the best of my ability. But first you ought to have these eight notable points especially in mind, if you

(20) GURLT, following MAZZUCHELLI, says that LEONARD had a son named GIOVANNI MICHELE who lectured on surgery in Padua in 1435-1436.

wish to be a perfect surgeon, and one who so holds them specially should be preferred to others (21).

At this point the printed text resumes, giving these eight essentials, but in a briefer form than that of the manuscripts. The chief discrepancy is in connection with the third qualification, « You ought to have light hands and expeditious in operating lest you cause the patient pain. » Here the manuscripts add, « For, my son, you heard him who said that I had light and expeditious hands when I extracted for him that bit of bone lodged in the hollow of the brain with that instrument of parchment through a small hole in the broken bone. And you saw that I thrust that

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(21) I give the Latin of the passage as it occurs in Sloane MS 3863 at fol. 38v. I think that it does not occur in the Florentine MS, Bisconiani 13, but I should need to examine that MS again to be certain. When I examined the Florentine MS, I had not yet seen the printed text of LEONARD's work, and was not aware that there would be such discrepancies between it and the MSS, nor was I as yet aware of the existence of the Sloane MS. Accordingly I took only a few pages of notes, and did not succeed in seeing the printed text until I reached Paris and London. In Paris I saw the 1546 and 1499 editions; in London I found the 1498 edition and the Sloane MS.

« *Sequitur De factura cranei.* Cum cupivi veritatem et diciplinam estimans nullam meliorem rem hominibus in hoc mundo posse percipere. Quare antequam scirem hoc nescivi si a deo an si a fortuna hoc accessissem (or perhaps, accessisset). Verum in arte manuali numquam novi plene imperitum ab imperito. Cum multi doctores atque periti decepti fuerant et maxime in vulneribus nervorum et fracturis capitis quare tot et tanta narrare quanta a veteribus narrata sunt esset quid (or, aliqnid) tediosum audire atque perconfusum et non bene capasibile non tunc (these two words are blurred in the MS and I am not certain of them) FABRICIO filio meo qui est xi annorum. Ideo in hoc meo opere.. ... . (there follows an abbreviated word which I could not make out; it looks like a modo) aliud sequar stilum non secutum a meis professoribus sed alegabo aliquos ubi sunt meo iudicio laude digni et narrabo mirabilia opera nature cum auxilio domino (*sic*) et sequendo modum et regulas antiquorum. Nam in hoc opere..... (the same word occurs again; perhaps admodum) intendo facere capitula specialia de unaquaque egritudine pertincti (pertractari?) ciroico. Incipiendo primo a capite declarando de ipsa theorice. Secundo tractando de ipsa practice et optima exempla dando. Et hoc secundum meam opinionem ponendo in formam consilii secundum quod habui in cura et vidi in civitate paduana rome verone venetiis in alexandria in civitate illa in qua MAUMETH a sarracenis in mecha pro deo colitur. Sed iuro per deum vivum et verum crucifixum nullum mendacium fili mi in hoc meo libro tibi facere iuxta meum posse. Sed primo oportet te hec octo notabilia bene in mente habere specialiter si vis esse perfectus ciroicus et sic habendo specialiter preferendus erit aliis. »

instrument to the depth of one finger into the hollow of the brain. And witnesses of this were the most famous monarch of the arts and doctor of medicine, master GALEATUS DE SANCTA SOPHIA (22), and master NICHOLAS the barber, and master GERA CERDO (or GERACERDO), and you, my son, who saw all these things. » (23)

Finally in illustration of our point may be noted a much longer passage in which LEONARD recounts one of his own cases under the caption, *Capitulum quod est exemplum*, in the Florentine manuscript, and *De quodam exemplo*, in the Sloane manuscript, but which is entirely omitted in such printed texts as I have examined.

« There came to me with the help of the divine Trinity a certain rustic named GAZABINUS with a nephew of his who once had been wounded with three knive-wounds, of which one was in the colon of the intestine, and when I first saw it, the excrement came out

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(22) The family of SANCTA SOPHIA included a number of noted medical men in successive generations. This GALEAZZO is presumably the one who died of plague in 1427. L. SENFELDER published his *Consilium pestilentiae* and another medical advice for a lord about to take a sea voyage, in the *Wiener Klinische Rund-Schau* of 1888. His works on fevers and the Ninth Book of RASIS to ALMANSOR were printed in editions of the early sixteenth century. He was a nephew of the more famous MARSILIUS de Sancta Sophia. TIRABOSCHI, *Storia d. lett. ital.*, V (1823) 394, however, ascribes a work on fevers, printed at Venice in 1514, and at Lyons in 1517, to this MARSILIUS de Sancta Sophia the younger, whom MICHAEL SAVONAROLA put first among the physicians of his time. GALEAZZO and MARSILIUS the younger are sometimes incorrectly identified, but there are two works on fevers in the 1517 edition at least, and SAVONAROLA clearly distinguishes between MARSILIUS Junior (who probably died about 1411) and GALEAZZO who had been his own teacher. SAVONAROLA also mentions DANIEL, JOHN and WILLIAM of SANTA SOFIA. *Libellus de magnificis ornamentis regie civitatis Padue* MICHAELIS SAVONAROLE, Muratori, *Scriptores*, new edition, vol. 24, part. XV, pp. 36-40.

(23) The portion of the passage which I have included in parentheses in the following Latin is found only in Sloane MS 3863 and not in Bisconiani MS 13.

« Nam fili mi audivisti illum qui dixit quod habebam manus leves et expeditas quando extrasi (spelled *extraxi* in the Sloane MS) sibi illud frustrum ossis existens in concavitate cerebri (cum illo instrumento de carta membrana per parvum foramen ossis fracti. Et vidisti quod fixi illud instrumentum ad quantitatem unius digiti in concavitate cerebri.) Et de hoc esset testis famosissimus monarcha artium et medicine doctor magister GALEATUS DE SANCTA SOPHIA et magister NICOLAUS barbitonssor et magister GERACERDO (*gera cerdo* in the Sloane MS) et tu fili mi qui hec omnia vidisti. »

through the wound, and it was in that place where the turning of the left reins is. Another wound was in the chest and penetrated it. The sign of this was that the air issuing from that wound exstinguished the flame of a great lighted candle. Another wound was in the spleen, for I saw that black melancholic blood issued from the wound. And this wound was below the false ribs on the left side. All which wounds in that nephew of his I had healed already. And from the intestinal wound came out a great worm just as the wound was closing up, which worm I extracted from the wound with my hands.

« Well, this GAZABINUS, whose son I had recently treated for fracture of the skull and cured, said, « My son PASQUALINUS, with the brother of this one whom you saved from death, struck a certain young porter with a boar-spear and drove in the ear of the spear into the head a bit to one side and not far from the coronal commissura, — about an inch below it. » But two other men who were with him swore to me that as soon as they applied white of egg, some of the substance of the brain came out together with blood. This I was certainly (not) willing to believe. But I bethought me of the words of GALEN in the sixth part of the Aphorisms in that aphorism *Vessicam incisam*, etc. In the commentary GALEN says of the brain, « Incision of the brain, too, I have seen healed, for once in Nimba, a city of Samaria (24), I saw a man have a great concave incision of the brain and yet escape death, which happens rarely. » Also ARNALD OF VILLANOVA in his *Practica*, the third tractate, says that he has heard the same thing from the most skilful surgeons about the substance of the brain coming out and the patient's escaping death. But this I saw with my own eyes, some of the substance of the medulla again come out in this patient, whom I cured alone without other advice (with a stylus) in the presence of many doctors and scholars of Padua whom I led with me by prayers and charity, that they might see the possibility of nature, namely, manifest and ample separation by two fingers' breadth of the first anterior ventricle in which imagination takes place from the middle ventricle in which cogitation or reason

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(24) In the text of GALEN, Smyrna in Ionia is the place referred to : see KÜHN, *Medicorum Graecorum Opera quae exstant*, 1829, XVIII, i, 29.

goes on, while the third posterior ventricle where retentive or treasuring virtue acts was unaffected as far as I could see (25).

« In such a man living all those three virtues were always as it were healthy and without any accident of all the various accidents accustomed to appear in dispositions of this sort, such as vomiting, sincope, *singultus*, spasm, mental alienation, fevers, and epilepsy. The nutritive, animal, and vital virtue was always that of a healthy person until the thirty-fourth day, on which occurred five attacks of epilepsy and great sweats and continuous fever. And this was from a primitive cause, namely, from drinking mountain wine without my knowledge. But it is true that that day was also a critical day, salubrious and radicative according to my computation of the number of critical days in medicine. But when that day passed, weakness remained in the motive virtue of the opposite parts, the feet and hands, but how I proceeded in curing him both practically and theoretically I will tell below » (26). This promised account of his treatment of the case is given in the printed text as well as the manuscripts, although in a somewhat condensed form, and so need not be repeated here.

In the colophon to the Florentine manuscript the copyist of 1471 volunteers a bit of information or gossip, which is not found in the printed editions or in the Sloane manuscript, to the effect that LEONARD, although a most excellent professor of surgery, had never taken his degree, apparently on the ground that there were so many unworthy holders of the doctorate (27), and that « he preferred to be a good squire rather than a poor knight ». In the printed editions,

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(25) These old views of the activities of the ventricles of the brain seem to have survived until FRANZ JOSEPH GALL's *Anatomie et physiologie du système nerveux*, 1810-1820, and even later. See G. ELLIOT SMITH's recent address on The Human Brain, printed in his *The Evolution of Man*, 1924 (reviewed in *Isis*, VII, 149-52). SMITH says of GALL, « It was he who destroyed the ancient speculations concerning vital spirits dwelling in the ventricles of the brain. » And again, « It was not until more than thirty years after GALL's death that the localization of function in the cerebral cortex began to be seriously entertained. » GALL died in 1828.

(26) In spots the passage seems a trifle incoherent, and I have had to guess at the text or meaning. But its general trend is clear enough. In the Latin text, which is given at the close of this paper, I have collated our two manuscripts, adopting the more usual spelling or form in each case of variation. Possibly it is just because of the textual difficulties that such passages present that they have been omitted in the printed editions.

however, LEONARD is called « doctor » as well as « master », but I think that the Sloane manuscript employs only the latter title and « professor ».

In any case LEONARD of Bertipaglia is an interesting representative of the relations between medicine and surgery in the fifteenth century, and this is brought out especially by the very passages that have been omitted in the printed editions. We see that the surgeons of that time were not necessarily either mere barbers or bookish theorists. Even the printed editions contain a passage against barbers as surgeons, and it occurs in the spurious seventh treatise *De antidotis*, which we have shown to be by someone else than Leonard, and so may be regarded as additional testimony confirming the impression that we have already received from his work. The aforesaid spurious treatise opens : « These are secrets to be memorized and magnified, and not given into the hands of barbers or of those who through failure to understand them vituperate good authors, as if these seem to have written badly, and yet their sayings are of the best. But those ignorant fellows do not know how to operate, wherefore men ought rather to commit themselves to the hands of skilled surgeons than to those of ignoramuses and barbers, whom we ought utterly to scorn and neglect » (28).

Leonard was of this class of skilled surgeons and operating practitioners. Yet he was also widely read in medical literature from GALEN's Commentaries on the Aphorisms of HIPPOCRATES down to the 181st *Differentia* of the *Conciliator* of PETER OF ABANO (29), and

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(27) It is difficult to construe or translate the words, « propter excusare vituperium multorum doctorum. » The complete colophon reads : « Expletum est hoc opus compositum Padue anno 1424 per excellentissimum professorem cirurgie magistrum LEONARDUM de Bertapalea qui numquam voluit graduari propter excusare vituperium multorum doctorum ignorantium; nam potius voluit esse bonus scutifer quam malus miles. »

(28) « Haec sunt secreta commendanda memorie et magnificanda nec danda manibus barbitonsorum nec qui male intelligendo auctores bonos vituperant quasi male videntur scripsisse, et tamen eorum dicta optima sunt. Sed isti ignari nesciunt operari unde potius homines deberent se committere manibus peritorum quam ignorantium et barbitonsorum, quos aspernari et negligere prorsus debemus... »

(29) Sloane 3863, fol. 98r, « Experimentum conciliatoris seu magistri PETRI DE ABANO quod curat fracturas cranei absque elevatione ossis. Unde lege conciliatorem quia dicit de hoc experimento in differentia 181... »

the books of BERNARD GORDON, ARNALD OF VILLANOVA, WILLIAM OF SALICETO, and WILLIAM OF VARIGNANA, or the still more recent works of PIETRO DI TUSSIGNANO (died about 1411) and PIETRO D'ARGELLATA (died 1423). In a sentence which is omitted in the printed text he advises the prospective surgeon to « read and well read through our predecessors, if you would know in what way and how and when these things should be done » (30). He was on good terms and a footing of equality, it would seem, with his medical colleagues of the highest reputation at Padua. He appears at one time to have traveled as far as Alexandria in Egypt, if not to forbidden Mecca itself (31). A new edition of his text, based on the manuscripts, of which others can probably be found than the two that I have used, would seem to be highly desirable.

APPENDICES

I. THE TWO DIFFERENT PROLOGUES OF THE MANUSCRIPTS AND EDITIONS

A. Text from Bisconiani 13, fol. 1, and Sloane 3863, fol. 1.

Tertia fen quarta canonis AVICENE.

Incipiamus ergo in nomine domini yeshu Christi Amen. et gloriose virginii marie eius (que) matris qui me et vos (omnis) discentes confirmet in via cognoscendi (in) semita veritatis et virtutis et reprimat appetitus bestiales et corroboret cor meum et vestrum ingenium ad suum servitium et honorem ut valeam et possim humilique placentia lingua promere vobis in scriptis hec multa archana (*organa* in Bisc. 13) que vestro (*nostro* in Sloane 3863) pectori non intendimus vestris (*nostris* in Sloane 3863) clericas occupare quoniam non laudo hominem hanc artem ignorantem qui voluit (*cum voluerit* in Sloane 3863) prodesse nocebit

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(30) Sloane 3863, fol. 93r, « Qualiter lege et bene perlege nostros precessores si vis scire quomodo et qualiter et quando ista debent fieri... »

(31) See note 21 above.

sicut fuit bonus homo de Andria civitate qui cum (hoc) acquisitus fuisset (*fuit* in Sloane 3863) multam pecuniam ex uno solo experimento de nostris se nesciente acquisivit (sibi) nomen optimi medici et in tantum se inanivit quod ex vana gloria ipse redundatus est ab aliis medicis scientificis in vituperium. Quare fili pro tua vera salute et intellectus tui declaratione labora addiscendo ne ingrediaris esse de secta metoicorum vel stoicorum atque imperitorum ut nobis clare patefacit Galen in tercio de ingenio sanitatis.

The words enclosed in parentheses occur in only one manuscript.

In style this prologue seems influenced by the ***Medical Experiments*** ascribed in the middle ages to GALEN or RASIS : see my *History of Magic and Experimental Science*, Chapter LXIV.

B. Text from the printed editions.

Altitonantis implorabo auxilium quo sine nullum rite fundatur exordium nec ad medii finisque alicuius bonitatem ullam sane quis pervenire poterit, ut intellectus mei dilucidare dignetur ingenium ut valeam (ut) ego Leonardus plura mei canonica chirurgiae experimenta in scriptis ad aeternam memoriam redigere quae vero (*et quae* in the 1546 edition) experimento ac ratione theorica habuerim AVICENNE prosequendo vestigia et ordinem 3 super Fen Canonis quarti.

A manuscrupt of LEONARD's work with this form of the prologue was formerly contained in the library of the monastery of St. Michael at Murano near Venice ; see MITTARELLI, *Bibl. codd. MSS. mon. S. Michaelis*. 1779; MS. 103, chartac., 15th century.

II. TABLE OF CONTENTS FROM SLOANE MS 3863, fols. 109r–110r

Incipit rubrica seu tabula fen tertii quarti canonis de apostematibus calidis et curis eorum. Et primo de flegmone.

Tractatus primus continet in se hec capitula, etc.

de flegmone et cura eius
de erisipula et cura eius
de formica tam ambulativa quam corosiva et miliaris et cura eorum
de igne persico et pruna etc.
de inflacionibus et vesicis etc.
de esseribus et curis eorum
de cancreno et aschachilo et herpestiomeno et curis eorum
de altoyn sive carbunculo etc.
de apostematibus que oriuntur in locis glandinose cornis et non venenosis etc.
de exituris
de dubelet calido
de forunculo et cura eius
de moro et cura eius

Tractatus secundus de apostematibus frigidis et curis eorum

de undimia et cura eius
de nodis et curis eorum
de nata quid est apostema glandosum
de pustulis glandulosis etc.
de fugille et cura eius
de scrophulis et curis eorum
de sephiros et cura eius
de duritie iuncturarum
de almismar id est callus etc.
de cancro et cura eius
de apostematibus ventosis etc.
de vena medena seu civili etc.

Incipit fen quarta quarti canonis de solucione continuitatis in carne, in nervis et ossis (*sic*) etc.

de diffinitione solutione continuitatis
de iudiciis mortis et periculi in quibus communicant vulnera quorundam membrorum
de sermone universali vulnerum quid incipit vulnus carnosum etc
de cogitatione eius quid facit (?) nasci carnem
de medicinis incarnativis
de perforatione vulneris et aliorum cum oportet quid (quod ?) discooperiantur
de vulneribus habentium apostemata et malam complexionem
de vulnere in ventro et modo suendi
de qualitate modo ligandi
de medicinis incarnantibus vulnera
de medicinis consolidatis et sigillatis
de facientibus nasci carnem in vulneribus
de vulneribus que fiunt in capite abque lesione ossis cum vulnere et contusione

Incipit tractatus secundus de offensione et contusione et actritione et excoriatione et punctura et fluxu sanguinis.

de sermone generali
de contusione et actritione et cura
de casu et offensione
de offensione supra ventrum et viscera
de verberatis et flagellatis
de torsione sive egaumau et quia maxime fit in membris officialibus sicut adiutorium et ancha
de excoriacione que fit a sutiliaribus aut a lapide aut ad parietem etc.
de punctura et disruptione eius quod retinetur in carne ex spinis et sagittis et fuscis et silibus
de combustione ignis quocumque
de fluxu sanguinis a vena vel ab arteria et cura eius

Incipit tractatus tercius de ulceribus et primo de sermone universali de omnibus ulceribus

de diffinicione ulceris
de curacione omnium ulcerum in universali
de ulceribus virulentibus
de ulceribus sordidibus
de curacione ulcerum profundorum et cavernarum et absconsionum
de curacione vermium in ulceribus
de nascentibus carnis in ulceribus
de curacione ulcerum corodentium se preter putride
de curacione ulcerum putridorum malorum
de curacione ulcerum que sunt difficilia consolidacionis et dicuntur ambulativa
de curacione fistularum et corrosionum que non conglutinantur absque labore
de carne addita super vulnera quomodo et qualiter debent (*sic*) removeri
de regimine ulcerum quando disrupuntur post consolidacionem
de hiis que habent removere vestigia vulnerum et ulcerum

Incipit tractatus quartus de solutione continuitatis nervorum

de sermone universali
de curacione solucionis continuitatis nervorum in universali
de medicinis ipsorum vulnerum et ulcerum
de apostematibus que accidunt nervis vulneratis
de actritione nervorum et eius torsione
de iudiciis et extractione nervorum corruptorum
de duricie nervorum atque torsione ipsorum
de remocione egritudinum ossium
de ventositate spine et corruptione ossis et curis eorum
de modo secandi os corruptum et qualiter medicus se debet habere
de extractione frustris (?) ossium et corticum eorum que remanent in ulceribus consolidandis
de medicinis convenientibus in fine fracturarum ossium
de fractura cranei
de fractura capitis in forma consilii in quo continentur xi notabilia (in the text this is market cap. 1)
de quodam exemplo (cap. 3 in the text; there is no cap. 2)
de fractura capitis in universali et hoc theorice (cap. 4 in the text)
de curatione fracturarum ossis capitis et hoc in universali
de ordine receptorum
de dyeta
de iudiciis et cautelis cirogitorum quod in certis casibus et maxime in fractura cranei necesse prodest uti et sunt decem iudicia sive notabilia
de iudiciis vulnerum significancium mortem per singula membra habencia aspectum secundum xii signa celestium aut salutem et hoc cum maxima difficultate et hoc primo incipienda ab ariete

(twelve chapters follow on the conjunction of the sun with the moon in each of the twelve signs of the zodiac with reference to the head, neck, arms, lungs, heart, in naturalibus, in anchis, virga, coxa, genu, tibiis, pedibus)

Tractatus de iudiciis secundum aspectus signorum celestium

de circulo zodiaci considerando
de aspectibus in qualibet egretudine
de nominibus aspectuum
de cognicione concordancie signorum penes eorum complexiones
de signis planetarum
de planetarum (?)
de laudibus huius sciencie que pertinet ad medicum de aspectibus tractando.
Deo gracias Explicit tabula sive rubrica.

III. LEONARD'S SURGICAL PRACTICE WITH THE FAMILY OF GAZABINUS

Capitulum (tertium) quod est exemplum.

Venit ad me cum auxilio divine trinitatis quidam rusticus et nomine GAZABINUS cum uno suo nepote qui quondam fuit vulneratus tribus vulneribus et cum uno cultello quorum unum vulnus erat in intestino colum et exivit pro tunc quando primo vidi stercus de vulnere illo et erat in illo situ ubi est revolutio renis sinistri. Aliud vulnus erat in casso et penetrabat signum fuit quod aer exiens de illo vulnere extinxit ignem unius magne candelle accense. Aliud vulnus erat in splene quoniam vidi quod exibat de vulnere sanguis niger melancolicus. Et tale vulnus erat sub costis mendosis in parte sinistra que omnia vulnera in illo suo nepote iam liberaveram. Et de vulnere intestini exivit magnus lumbricus *quasi in fine consolidationis quem lumbricum* (the words which I have just italicized are omitted in the Sloane MS) extrasi de vulnere cum manibus meis.

Dixit itaque dictus GAZABINUS cuius filius adhuc de fractura cranei iam habui in cura et liberavi : Filius meus PASQUALINUS percussit (se) cum fratre istius quem tu a morte sanasti quemdam iuvenem portatorem cum uno spito de zinglario et auriculam spiti fixit in capite modicum laterabiliter et parum distans a commissura coronali per unam unguem infra. Sed duo alii homines qui erant secum iuraverunt mihi ex illa hora cum sanguine exire de substantia cerebri quando posuerunt albumen ovi hoc non (in Biscon. 13 *modo* occurs instead of *non*) certe volui credere. Sed recordans (me) ex verbis GALIENI sexta particula afforismorum affo. illo *Vessicam incisam etc.* In commento dicit G. de cerebro, Incisionem quoque cerebri vidi sanari semel enim vidi in nimb(i)a civitate Samar(i)a quemdam magne et concave incisum cerebrum habere et tamen mortem evadere quod contingit rarissime. Item ARNALDUS (RENALDUS in the Sloane MS) de Villanova in sua

practica *et in tertio tractatu* (the words just italicized are omitted in the Sloane MS) dicit hoc idem audivisse a peritissimis cirurgicis de substantia cerebri exiri et a morte egrotantes evadere. Sed hoc vidi oculis meis de substantia medulari iterum in hoc egro exire quem curavi solus sine alio conscilio (in place of this word, MS Biscon. 13 has *cum stillo*) in presentia multorum doctorum et scolarium paduanorum quos precibus meis et caritate mecum ducebam ut viderent possibilitatem nature scilicet separationem manifestam et amplam per duos digitos primi ventriculi anterioris in quo inmaginativa perficitur a separatione medii ventriculi in quo cogitatio sive ratio perficitur et tertius ventriculus posterior ubi fiat retentiva sive virtus thesaurizativa (Sloane MS has instead *restaurativa*) non fuit pro tunc (protinus ?) ad oculum mihi notum.

In tali homine vivo omnes iste tres virtutes fuerunt semper sicut sane et sine aliquo accidente omnibus accidentibus numeratis solentibus apparere in huiusmodi dispositionibus sicut vomitus sincopis singultus spasmus alienatio mentis febres et epilensia etc. Virtus nutritiva animalis vitalis semper fuit sicut sane (sani ?) usque ad trigesimum quartum diem in qua die supervenerunt sibi quinque parosismi epilensie cum magno sudore et febre continua. Et hoc fuit a causa primitiva scilicet a potatione vini montani me nesciente. Sed verum est quod illa dies fuit etiam dies cretica salubris et radicativa secundum quod numeravi per computacionem dierum medicinalium creticorum. Sed transacta illa die remansit debilitas in virtute motiva ex parte contraria pedis et manus sed modum qualiter ego processi ipsum curando tam practice quam theorice inferius narrabo.

Sloane MS. 3863, fols. 91v-92r;
Bisconiani MS. 13, fols, 57v-58r.

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Another Treatise by Barnabas de Riatinis of Reggio.

The purpose of this note is to call attention to a work by BARNABAS DE RIATINIS of Reggio which is not mentioned by G. ALBERTOTTI in his article, « Magister BARNABAS de Regio ed il suo *Libellus de conservanda sanitate oculorum* » (1). Besides this treatise on preserving the health of the eyes, which was written in 1340 and which ALBERTOTTI has printed (2), ALBERTOTTI noted another work on the preservation of health in general, *De conservanda sanitate*, written by BARNABAS at Mantua in 1331. But the work which I would note is a treatise on foods, completed by BARNABAS at the end of November, 1338 at Venice and entitled, *De naturis et qualitatibus alimentorum*. It is found by itself in a manuscript of the fourteenth century at the Laurentian Library (3) in Florence, and covers fifty leaves, but the number of words to a page is not great, so that the treatise is not a long one.

Whereas the *Libellus de conservanda sanitate oculorum* was, according to ALBERTOTTI, dedicated to the Patriarch of Aquileia, BELTRANDO SI SAN GENESIO, our present treatise is dedicated to another prelate, GUIDO of Regio (or Reggio), bishop of Concordia (4). Its being penned at Venice in 1338 fits in with the Venetian documents noted by ALVISI (5) and CECCHETTI (6) which showed that BARNABAS

(1) Pavia, 1896, pp. 3-12; Estratto dagli *Annali di Ottalmologia*, XXV.

(2) Ed. G. ALBERTOTTI, Modena, 1895.

(3) Ms. Gaddi reliq. 209; noted in BANDINI's Catalogue, vol. X (Suppl. ad Cat. II).

(4) GUIDO de Guisis was bishop of Concordia from 1334 to 1347 A. D. See GAMS, *Series Episcoporum*, 1873, p. 788; EUBEL, *Hierarchia Catholica*, I (1893) 241.

(5) G. G. ALVISI, « Considerazioni documentate sull' arte medica e sul personale sanitario di Venezia dal X al XV secolo, » in *Giornale Veneto di Scienze Mediche*, Tom. XI, Ser. II, (1858), pp. 463-500.

(6) « Vita del Veneziani nel secolo XIV, » in *Archivio Veneto*, Nuova Serie, XXV (1883), 361-81; XXVI, 77-111, 251-70.

was « maestro conventatus in fisica e filosofia 1334... approvato negli anni 1335, 1338, 1341, 1343, 1350, 1352, 1353 » (7). Similarly the colophon of our manuscript states, « Finitum fuit hoc opus Venetiis per predictum magistrum BARNABAM salariatum ibidem ». Our manuscript further confirms ALBERTOTTI's conclusion that BARNABAS DE RIATINIS and BARNABAS OF REGGIO are one and the same, since it calls him « de Reggio » at least once.

The arrangement of this treatise on foods is alphabetical. Under F, for example, BARNABAS considers the natures and qualities of *Frumentum, Far, Ficus, Faseoli, Fabe, Feniculus, Fungi, and Fistici.* Under the letter P there are thirteen chapters : *de pane, de piscibus, de pomis, de portulace, de prunis, de porio, de pipere, de penidiis, de persicis, de petrosellis, de panico, de pastinaca, de pineis.* The longest chapter by far is that on meat or flesh, *caro.* It covers over sixteen pages and is divided into six sections treating : 1) of meat according to all its species and modes; 2) of flesh in special and first concerning domestic fowls and chicken meat; 3) of the flesh of wild birds; 4) of domestic quadrupeds; 5) of wild quadrupeds; 6) of the members or parts of animals, both interior and external.

Columbia University. LYNN THORNDIKE.

(7) ALBERTOTTI, « Magister BARNABAS de Regio ed il suo *Libellus de conservanda sanitate oculorum* », p. 5

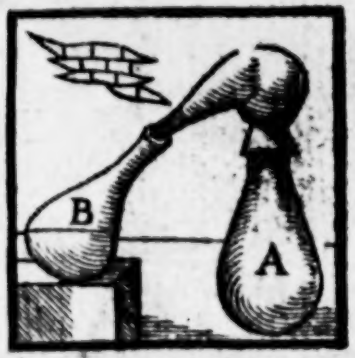
OPVSCVLE
TRES-EXCELLENT,
DE LA VRAYE PHILOSOPHIE naturelle des Metaux.

Traictant de l'augmentation & perfection d'iceux.
Auec vn aduertissement d'euiter les folles despenses qui se font par faute de vraye science.

Par Maistre D. Zacaire Gentilhomme Guiennois.

Plus le traitté de M. Bernard Allemand Compte de la Marche Treuisane.

Derniere edition reueu & corrigé de nouueau.



A LYON,
Chez Pierre Rigaud, en ruë Merciere, au coing de ruë Ferrandiere à l'enseigne de la Fortune.

M. DCXII.

Huictain declarant le vray nom de la science.

Ceux q̃ en Chaldée ont esté biẽ apris
M'ont appellé (ô lecteur) la lumiere
D'augmentatiõ, & entre les diuins
Ouurages m'õt touſiours renõmée.
Fauſſemẽt dõc le cõmun populaire
M'a d'Alchimie cy deuãt dõné nõ,
Veu q̃ ie faiz des metaux la lumiere
Par tout reluire & augmẽter leur nõ.

Enigme enuoyé par l'Autheur à ſes amys.

TROIS demy tours ont porté ma grandeur,
Trois demy tours ont sẽty ma faueur
Trois demy tours ma grandeur font renaiſtre
Trois demy tours ma faueur font cognoiſtre. Vous ſouuiendra.
Ceux qui ceſte deuiſe cognoiſtront
Pour aſſeuré mon vray nom cognoiſtront.
Patient va à biens.

The Autobiography of Denis Zachaire
Title Page (Actual size of Page: 11.5 × 7.5 cms.) Enigma which conceals the identity of Denis Zachaire

The Autobiography of Denis Zachaire

An Account of an Alchemist's Life in the Sixteenth Century.

Denis Zachaire, Gentleman of Guyenne, or more properly the man who wrote under that name, had an interesting life if we may believe his own account of it. After many experiments, much trouble, and great expense, he transmuted base metal into gold, so he says, on Easter day of the year 1550 or thereabouts. Although his style is marred by an interminable succession of *and, but, if, which, because, therefore,* and *to wit,* his keen sense of humor more than compensates for it. He laughs at his own mistakes, and at the foibles of other alchemists. Perhaps he is satirizing alchemy in general, and for that reason writes under a pseudonym. At any rate, his narrative appears to be a frank account of the manner in which alchemical research was conducted during the second quarter of the sixteenth century.

« Being twenty years old or thereabouts, after having been instructed at our house in the principles of Grammar by the solicitude and diligence of my parents, I was sent by them to Bordeaux to attend the lectures on arts at the college, for there were ordinarily very wise teachers at that place. Here for three years I was a student, almost all the time in Philosophy, in which subject I made such progress by the grace of God and the solicitude of a private teacher whom my relatives had provided for me that it seemed well to all my friends and relatives (for during this time I had lost father and mother which left me all alone) that I should be sent to Toulouse, under the charge of the same master, to study the law.

« But I did not go from Bordeaux without having made the acquaintance of other scholars who had divers books of recipes collected from many sources which were familiar to me since my master took part in the work on them. I was not so lazy as to leave unturned a single page of all the books that I could get into my possession, with the result that before going to Toulouse I had a very large book of recipes, thick as the width of three fingers,

where I had written many projections, one upon ten, another on twenty, on thirty, one with its force divided by three and moderated for the red, one for eighteen carats, another for twenty, another for the gold of an *écu*, another for the gold of a ducat, others to make it of the highest color that ever was, some ought to sustain melting, others the touchstone, others all tests, and of other infinite sorts, one that ought to come to ten deniers, another to eleven, another to the silver of Teston, another white from the fire, another to the touchstone, so that it seemed to me that, if I should once have the means to practise the least of these recipes, I would be the happiest man in the world. And principally the tinctures which I had happened to find; certain of them bore the title of being the work of the Queen of Navarre, others of the late Cardinal of Lorraine, others of the Cardinal of Tournon, and of infinite other names, to the end (as I knew later) that one might have more faith in them, as indeed I did have at that time.

« Immediately that I was arrived at Toulouse, I set myself to building small furnaces, being confirmed in all things by my master. Then from small I went to large, and soon I had a room entirely equipped with them, some for distilling, others for subliming, others for calcining, others for dissolving in the water bath, others for melting, in such sort that for a beginning I spent in one year the two hundred *écus* which had been supplied to us for our support during two years of study. This was spent in setting up the furnaces and in buying charcoal, divers and infinite drugs, divers vessels of glass which I bought for six *écus* at a time, without counting two ounces of gold which were lost in practising one of the recipes and two or three *marcs* of silver for another, in which, if any of it was recovered, which was very little, it was crude and so blackened by the force of the mixtures which the recipes had ordered to be added that it was almost entirely useless.

« So, at the end of the year my two hundred *écus* were gone up in smoke. And my master died of a continued fever which seized him during the summer by reason of the soot that he breathed and swallowed, for he was so desirous of accomplishing something worth while that he hardly ever left the room where he made scarcely less soot than there is in the Arsenal of Venice where cannon are cast. His death was a great grief to me.

« Then, my near relatives refused to supply me any money more than was needed to maintain me at my studies, and, for myself,

I desired nothing better than to have the means to continue my experiments, a circumstance which constrained me to go to my home and to discharge the caretakers in order myself to have the management of my paternal estate.

« I rented it for three years for four hundred *écus* in order to have the means to expend upon one recipe among others that an Italian had supplied to me at Toulouse. And he assured me that he had seen it tested. I kept this man with me to see the outcome of his recipe, to practise which I was obliged to purchase two ounces of gold and a *marc* of silver. When these were melted together, we dissolved them in aqua fortis, then we calcined them by evaporation. We tried to dissolve them with divers other waters by divers distillations so many times that two months passed before our powder was ready to make the reprojection of it. We used as much of it as the recipe required, but it was in vain; the only increase that I received from it was in the fashion of the shortened pound. From all the gold and silver which I had used I recovered only half a *marc*, without counting the other costs which were not small. So, my four hundred *écus* were reduced to two hundred and thirty, and of this I supplied my Italian with twenty to go to find the author of the recipe, who he said was at Milan, in order that he might write back to us. After this I was at Toulouse all the winter awaiting his return, and I would be there yet if I had decided to wait for him — for I have not seen him since.

« Moreover, when the summer came it was accompanied by a great pestilence which made us quit Toulouse. And in order not to leave the companions with whom I was acquainted, I went to Cahors where I stayed six months during which time I did not forget to continue my enterprise. I was accompanied by a good old man, who was commonly called the Philosopher, to whom I showed my concoctions, asking his counsel and advice to see which recipes might seem to him to be the most apparent, to him indeed who had handled so many simples during his life, and he pointed out to me ten or a dozen which according to his advice were the best. These I began immediately to practise when I returned to Toulouse at the feast of All-Saints after the danger of the pest had ceased. So, all the winter passed while I was practising these recipes, and from them I received the same profit as from the first in such sort that after the feast of Saint John I found my four hundred *écus* augmented and become one hundred and sixty and

ten. But not for that did I cease always to pursue my enterprise. And the better to be able to continue it, I joined with an Abbé near Toulouse who said that he had the duplicate of a recipe for making our great work which a friend of his who followed the Cardinal of Armignac had sent to him from Rome and which he took to be perfectly assured. For this I furnished the hundred and he the other half. And we began to set up new furnaces in a wholly different fashion to work on it.

« Since a sovereign strong aqua vitae is needed to dissolve a *marc* of gold, in order to do it well we bought a very good amount of Guillac wine from which we extracted our aqua vitae by means of a large pelican in such manner that in a month we had passed and repassed it divers times, more than was needed. Then we needed to have divers vessels of glass to purify it and make it more subtle. We put four *marcs* of it in two large retorts of thick glass, along with the *marc* of gold which we had first calcined for a month in the full force of a flaming fire, and set up the two retorts each delivering into the other. When these were well luted, we put them on two large round furnaces, and bought for thirty *écus* enough charcoal all at once to maintain a fire under these retorts for an entire year. During this time we were always trying little recipes, and from them we gained the same profit as from the great work. For we would still be watching it at the present time if we had wished to wait until it congealed in the neck of the retorts, as the recipe promised, and not without cause as all coagulations are preceded by solutions.

« For a fact, we had not been working with the material in solution, for aqua vitae does not dissolve gold as experience will truly show. We found all the gold in powder, as we had put it in, except that it was a little more broken up. We made projection of this upon heated quicksilver according to the recipe, but it was in vain. I leave it to you to judge whether we were angry about it, especially Monsieur l'Abbé who had already published to all his monks like a very good public secretary that it remained only to have a beautiful lead fountain melted which they had in their cloister to convert it into gold immediately that our result should be achieved. But he had it melted at another time to provide material in vain for a certain German who stopped at his Abbey while I was in Paris.

« In spite of all this he did not cease to wish to continue his enterprise, and he advised me to set about to get together three or four hundred *écus*, and he would furnish the same amount, in order that I might go and live at Paris, a city which is today more frequented by divers operators in this science than any other in all Europe, and become acquainted with all sorts of people, to work with those in whom I recognized something worth while, and to divide it among us like two brothers.

« So we stopped our work, and I again rented my whole estate, and I went away to Paris with eight hundred *écus* in my pocket, determined not to go away from there until it was all spent or until I had found something worth while. But this was not without incurring the bad grace of all my relatives and friends who were anxious only to make me a Counsellor-at-law in our city for they believed that I would be a great legist. So, notwithstanding their prayers (after having made them believe that I was going to court to purchase a commission) I left my house the day after Christmas and reached Paris three days after the King's birthday.

« I remained there a month almost unknown to everyone, but after I had begun to frequent the artisans, such as the goldsmiths, founders, glaziers, makers of furnaces, and divers others, I was on speaking terms with so many that a month did not pass without my making the acquaintance of more than a hundred operators. Some were working on the tinctures of the metals by projection, others by cementation, others by solutions, others by the conjunction of the essence, as they would say of Emery, others by long decoctions, others were working on the extraction of the Mercuries of the metals, and others on the fixation of them. Hardly a day passed, not excepting feast days and Sundays, that we did not assemble at someone's lodging (and very frequently at my own) or at the great church of Notre Dame, which is the most frequented church in Paris, to hold parliament over the results which had been obtained the day before. Some would say, « If we had the means to commence again, we would do something worth while », and others, « If our vessels had held, we would be there », and others, « If we had our vessel of copper perfectly round and well-closed, we would have fixed the Mercury with the Moon », and so on, for there was not one among them who had done anything worth while and not one who was not accompanied by an excuse. For all this I was in no hurry to give money to them, for I knew already and

understood full well the expenditures that I had made on this sort of credit and on the assurance of such returns.

« Frequently during the summer a Greek came to our meetings who was esteemed a very wise man. He had spoken to a treasurer whom I knew, promising to do a very good piece of work for him, and my acquaintance with this man was the reason that I commenced working, as he was, to catch (so he said) the Mercury of Cinnabar.

« Since he needed filings of fine silver, we bought three *marcs* of it and made them into filings. He mixed these with the pulverized Cinnabar and made little pegs out of the mixture with an artificial paste, and cooked these in a well-covered earthen vessel for a certain time. When they were thoroughly dry, he melted them and submitted the material to cupellation, and we found three *marcs* and a little more of fine silver which he said had come from the Cinnabar while the fine silver which we had put in had flown away in smoke.

« If this was profit, God knows it. And I also knew it who had spent more than thirty *écus*, while he assured me always that there was some gain in it. The result was that before the following Christmas it was so well known in Paris that there was no son of a good mother among those who were working in the science (that is to say, in these sophistications) who did not know or had not heard speak of the pegs of Cinnabar, as apples of copper were spoken of at another time later, for fixing Mercury with the Moon.

« While these youthful pastimes were taking place, a foreign Gentleman arrived who was greatly experienced at sophistications, so much so that he ordinarily made profit out of it and sold his product to the goldsmiths. I sought his company as soon I possibly could, but it was not without learning finally that he thought me unworthy of suffrage. So I lived about a year in his company, and at last he showed me his secret which he esteemed very highly although there was nothing perfect about it.

« Meanwhile I informed my Abbé of all that I had been able to learn, even sending him an account of the process of the above-mentioned gentleman. He wrote back to me that he found no fault with the expense of my living a year longer at Paris, since I had already found such a beginning which he esteemed very great. This was contrary to my opinion, for I had always resolved within myself never to make use of any substance which would not remain always

as it appeared at the beginning, having already perceived very well that no pains are needed to be evil and to enrich oneself at the advantage of another. So, continuing my enterprise, I lived a year frequenting one, then another, of those who were said to have something worth while, and this, with the two years that I lived here previously, made three. I had moreover spent the greater part of the money, when I received word from my Abbé asking that I should return to him immediately on receipt of his letter. This I did, for I wished to please him in all things as we had sworn and promised together. When I reached there, I found letters which the King of Navarre (who was very curious in all scientific matters) had written, asking, if he ever had thought of doing anything for him, that he should bring it about that I should come to Pau in Bery [Béarn] to teach him the secret which I had learned from the above-mentioned gentleman and from others whom it was reported I knew, that he would treat me very well and would recompense me with three or four thousand *écus*.

« The words, four thousand *écus*, so tickled the ears of the Abbé that making himself believe that he had them already in purse, he would not rest until I had started on my way to Pau. I arrived there in the month of May and worked about six weeks, for it was necessary to obtain the simples first. And when I had finished, I received the recompense that I was waiting for. Although the King was willing to treat me well (I am silent about the good treatment that I received in his country as well as about the great friendliness that I perceived in certain gentlemen of his court, very few in number), it so happened that, being turned aside by the most important members of his court, even by those who had been the cause of my coming there, he sent me away with much thanks and asked that I should inform him if there were anything in his lands, which it was in his power to give me, such as confiscations or other comparable things, that he would give it to me gladly. This response annoyed me so much that without waiting for his lovely promises (having heretofore been nourished on them at my own expense) I started to return to the Abbé.

« But, since I had heard tell of a religious Doctor who was reputed, and with good reason, learned in natural philosophy, I wished to go to see him on my way back. He turned me aside in a great degree from all these sophistications. And after he had understood that I had studied in philosophy, and done the acts,

and been under a master at Bordeaux, as I recounted to him, he told me with great zeal that he blamed me greatly for not having gathered together as many of the books of the ancient philosophers as were ordinarily obtainable before having spent so much time and borrowed money on these evil and unhappy sophistications. I told him of the process which I had carried out, but he understood very well that I was saying what it was and that it would not undergo much of a test. He so turned me away from all sophistications toward occupying myself with the reading of the books of the ancient philosophers in order to be able to understand their true matter in which seems to lie the whole perfection of the science, that I went away to find my Abbé to render account to him of the eight hundred *écus* which we had put together and to communicate to him half of the recompense that I had had from the King of Navarre.

« Being then arrived at his house, I recounted everything to him, and he was greatly grieved about it, all the more so as I no longer wanted to continue the enterprise which I had undertaken with him, for he believed that I was a good operator. His prayers however did not avail to prevent me from following the advice of the good doctor, for the great and apparent reasons which he had adduced when I spoke to him. And when I had rendered account to my Abbé of all the expenditures which I had made, there remained to us ninety *écus* for each, and we went away on the next day.

« I went away to my house with the intention of going to Paris, and being there, of not budging from my lodgings until, from reading divers books of the natural philosophers, I had made some resolve as to how to carry on our great work, for I had said good-bye to all these sophistications.

« Wherefore, after I had collected advance rent from my tenants, I went away to Paris where I arrived the day after All-Saints in the year 1546, and there for ten *écus* I bought books on philosophy, ancient as well as modern, part of which were printed while others were written by hand, the *Crowd of the Philosophers*, the good *Trevisan*, the *Complaint of Nature*, and divers other treatises which have never been printed. And having hired for myself a small room in the *faubourg* Saint Marceau, I lived there for a year, with a small boy who served me, without frequenting anyone, studying day and night on those authors, with the result that at the end of a month I made one conclusion, then another, then I added to it, then

I changed it almost entirely. So, while waiting for a conclusion in which there was no variety nor contradiction between the sentences of the books of the philosophers, I spent an entire year and part of another without being able to gain over my study to the extent of being able to make any entire and perfect conclusion.

« Being in this perplexity, I began again to frequent those whom I knew who worked on this divine work (for I no longer haunted all the other operators whom I had known formerly who worked on these evil sophistications), but, if I had in my understanding a contrariety arising from study, it was increased by considering the divers and variable manners in which they worked. For if one was working with gold alone, another with gold and Mercury together, another added some lead which he called *Sonnant* because it had passed through the retort with quicksilver, another converted certain metals into quicksilver with a diversity of simples by sublimation, and another was working with an artificial black atrament which he said was the true substance of which RAYMOND LULLY made use for the composition of this great work. If one was working in an alembic, others were working in many and divers vessels for a fact, one in vessels of brass, another of copper, another of lead, another of silver, but some in vessels of gold. Then, one made his decoction at a fire made of great coals, another of wood, another of grapes, and another with the heat of the Sun, and others at the water bath, in such sort that their variety of operations and the contradictions which I had seen in the books would almost have driven me to despair. Then, inspired of God by his holy spirit, I began to reread with very great diligence the works of RAYMOND LULLY, principally his *Testament* and *Codicil*, which I reconciled so well with a letter which he had written in his time to King ROBERT and with a porridge recipe which I had received from the above-mentioned doctor, to whom it was useless, that I made a conclusion from them wholly contrary to all the operations which I had seen formerly but such that I read nothing in all the books which did not harmonize very well with my opinion, even the conclusions which ARNOLD OF VILLANOVA, who was master of RAYMOND LULLY in this science, has made at the end of his *Great Rosary*. Thus I lived about one year longer without doing anything except read and think about my conclusion day and night, waiting, until the term for which I had rented my goods should be passed, to return to work at my own home.

« Determined to practise the above-mentioned conclusion, I arriv-

ed there at the beginning of Lent, during which I provided myself with everything that I needed and set up a furnace for working, so that I commenced it the day after Easter. But this was not without having divers impediments, on the most important of which I am silent, from my nearest relatives and friends. One said to me : « What do you want to do? Haven't you spent enough on such follies? » Another assured me that if I continued to buy such a menu of charcoal I would be suspected of making false money, as indeed he had already heard spoken of. Then there came another telling me that everyone (even the most important people of our city) were finding it very strange that I did not take up the profession of the long robe, since I was a licenciate in law, in order to attain to some honorable office in the city. Others who were nearer to me ordinarily tempted me, saying, why didn't I bring an end to those foolish expenses, and that it would be more to my advantage to save the money to pay my creditors and to buy some office, threatening me further that they would have the authorities come to my home to break up everything for me. They said further, « If you won't do anything for us, have some respect for yourself. Consider that being about thirty years old, you appear to be fifty, since your beard has commenced to turn gray, and makes you seem very aged, from the pain that you have endured in the pursuit of your youthful follies », and a thousand other pieces of comparable advice with which they ordinarily importuned me.

« I leave it to you to imagine whether this talk was a bore to me, since at this time I was seeing my work go from better to better, and I was always attentive to the conduct of it in spite of these and comparable other delays which came upon me incessantly, and especially the danger of the plague which was so great during the summer that there was no foot-travel or traffic which was not interrupted, in such manner that a day did not pass that I was not looking with very great diligence for the appearance of the three colors which the philosophers have written ought to appear before the perfection of our divine work. These, thanks to the Lord God, I saw, one after another, for on the very next Easter day I saw the true and perfect experience of them on quicksilver heated in a crucible which I converted into fine gold under my own eyes in less than an hour by means of a little of this divine powder.

« God knows if I was delighted about it. But I did not boast for

all that. But after having rendered thanks to our good God who had shown me such favor and grace through his son, our redeemer, Jesus Christ, and after having prayed that he would illuminate me by his holy spirit to enable me to use it for his honor and praise, I went away on the next day to find the Abbé at his monastery to fulfil the covenant and promise which we had made together. But I found that he had died six months previously — at which I was greatly grieved. So it was also with the death of the good doctor, of which I was informed while passing near to his convent.

« I therefore went away to a certain place to wait there for a friend of mine and near relative, with whom I had lived at my residence and whom I had left there with authority and express instructions to sell all and each of the paternal goods which I had, to pay my creditors with the proceeds, and to distribute the rest secretly to those who were in need of it in order that my relatives and others might feel some benefit from the great good that God had given me without anyone being the wiser. But they thought on the contrary that, despairing and ashamed of my foolish expenditures, I had sold my goods in order to retire to another place, as this friend of mine informed me when he came to find me on the first day of July. And we went to Lausanne, having decided to travel and to pass the rest of my days in a certain very renowned city of Germany, with a very small household in order that I might not be known even by those who see and read this little book of mine during my lifetime in our country of France. »

The foregoing narrative is translated from the French of the 1612 (Lyon) edition, the title page of which is reproduced herewith, and constitutes the major portion of the first part of the work. The second part describes the proper method for reading the books of the philosophers and details the conclusions which may be derived from them. Its style is such that it is difficult to tell whether the author is conscious of the flaws in his reasoning or is trying to make the faulty arguments appear plausible for the purpose of satirizing them. But the latter belief seems the more likely since he is writing under a pseudonym. The third and last part describes the great work in allegorical language.

The treatise of Denis Zachaire was printed in French at Antwerp, 1567 (1, 2, 3), and at Lyon, 1612 (4, 5), in both cases along with the treatise of Bernard, Margraf Trevisan. It was printed in German at Halle, 1609 (3, 4), at Dresden and Leipzig, 1724 (6), at Frankfurt and Leipzig, 1773 (4), and at Vienna, 1774 (6). It was printed in

various collections of alchemical writings: in Latin in Dorn's « Trevisanus de Chymico Miraculo », etc., Basel, 1583 (1, 6) and 1600 (1, 4), in ZETZNER's « Theatrum Chemicum », Vol. I, p. 804, Ursellis, 1602 (1, 5), another edition, Vol. I, p. 710, Argentorati, 1659 (4), and in MANGET's « Bibliotheca Chemica Curiosa », Vol. II, p. 336, Geneva, 1702 (1, 4); in French in SALMON's « Bibliothèque des Philosophes Chimiques », Paris, 1672 (1), and in RICHEBOURG's collection of the same title, Paris, 1740 (4); and in German in DARIOT's « Die gulden Arch, Schatz, und Kunstkammer », etc., Basel, 1614 (4), and in the « Eröffnete Geheimnisse des Steins der Weisen », etc., Hamburg, 1708 (4). I have found no record of an English version.

The romantic ending which the eventful life of DENIS ZACHAIRE seems to require has been supplied, apparently out of the imagination, by MARDOCHÉE DE DELLE, court poet of RUDOLPH II, who has told how our hero was married in Switzerland and started to travel. While stopping at Cologne, he was murdered in his sleep by a servant who escaped with his wife and his store of transmuting powder. FIGUIER (7) says that « the event made considerable noise in Germany, but no traces of the assassin could be found ». Concerning the poem of DE DELLE, he says that he would quote it if he « were not afraid of giving an unfavorable idea of the merits of hermetic poetry ».

The basic facts of ZACHAIRE's life have been developed in a somewhat different, but no less romantic, manner by PERCY ROSS in a novel (5) entitled « A Professor of Alchemy », published by GEORGE REDWAY, London, 1887.

LENGLET DU FRESNOY asserts (8) that « it is believed » that the name of DENIS ZACHAIRE is a « *nom de guerre* » under which the true

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(1) Reported by LENGLET DU FRESNOY, « Histoire de la Philosophie Hermétique », La Haye, 1742.

(2) Reported by HOEFER, « Histoire de Chimie », 2nd. ed., Paris, 1866.

(3) Reported by KOPP, « Die Alchemie in älterer und neuerer Zeit », Heidelberg, 1886.

(4) In the library of JAMES YOUNG. FERGUSON, «Bibliotheca Chemica: A Catalogue of the Alchemical, Chemical and Pharmaceutical Books in the Collection of the late JAMES YOUNG of Kelly and Durris, Esq., LL.D., F.R.S., F.R.S.E.», Glasgow, 1906.

(5) In the library of the present writer.

(6) Reported by FERGUSON, *op. cit.*, but not in the library of JAMES YOUNG.

(7) FIGUIER, « L'Alchimie et les Alchimistes », 3rd. ed. p. 175, Paris, 1860.

(8) *Op. cit.* Vol. 1. p. 287.

identity of the writer is concealed, but gives no reason for the opinion. Had ZACHAIRE really made gold as he claimed, it seems likely that he would have wished to make capital of his discovery and would have sought to make himself better known, as the other gold-makers did. Had he failed to make gold, the falsity of his claim would well supply sufficient motive for the concealment of his identity.

The second part of the book makes clear that its author was well informed on the writings of the alchemists and on the methods of reasoning which they employed. It appears that he knew them so well that he was capable of satirizing them, for he presents faulty reasoning so plausibly that it appears preposterous. Indeed, he seems to have done for alchemy what CERVANTES and DON QUIXOTE did for knight errantry.

While the satirical nature of the book provides a probable reason why he might have wished to remain unknown, the enigma (reproduced herewith) which is printed on the page after the title page of the French edition of 1612 appears to supply real proof that he used a pseudonym. The enigma is not printed in the Latin version of the Theatrum Chemicum, presumably for the reason that it would lose its significance if translated out of French. The author says that « those who will understand this device will know my true name for certainty ». The *trois demy tours* appears to offer a clue to its solution. Perhaps three turrets is the coat-of-arms of some family of Guyenne, and will lead us to infer the identity of this gentleman satirist of alchemy.

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The Weingarten Planetarium

1. — Origin of the Figure

The planets being our closest neighbours after the moon, they have from time immemorial arrested men's attention, and provoked them to admiration at least, when not to worship. Sun and moon of course ranked as largest and most important luminaries; but the planets exercised a fascination of their own over acute observers of the heavens, by reason of their mystic swaying motion and their oppositions and conjunctions all along the broad celestial girdle of the Zodiac. Astrology and astronomy were both born from the wonder thus provoked, and though both went hand in hand for many centuries, there was in many quarters a feeling that some definite physical laws determined all these revolutions in the heavens. What those laws are we now know, thanks to Copernicus and Kepler; previous attempts at solution, such as that of Ptolemy in his *Almagest*, having been quite superseded in spite of all their mathematical ingenuity.

There remains to be considered, however, another series of laws, those namely that regulate the positions of Sun, Moon, and planets in connection with our days and nights throughout the year. The determinants in this case are chiefly three : the yearly circling of the earth in its orbit, its daily revolution on its axis, and the inclination of this axis to the plane of the ecliptic. Ancient and mediaeval astronomers were well aware of the inclination of the ecliptic, and knew accurately enough the *effects* of the other two determinants, though positing motion in the sun and heavens and not in the earth. Hence mediaeval endeavours to represent the positions of the planets by day and night throughout the year, when cleverly worked out, need not *a priori* be discarded as of no practical utility.

It is to a scheme of this kind that the following pages are devoted; and we think it will not be over difficult to show that besides the historical interest of the « Weingarten Planetarium », as it seems

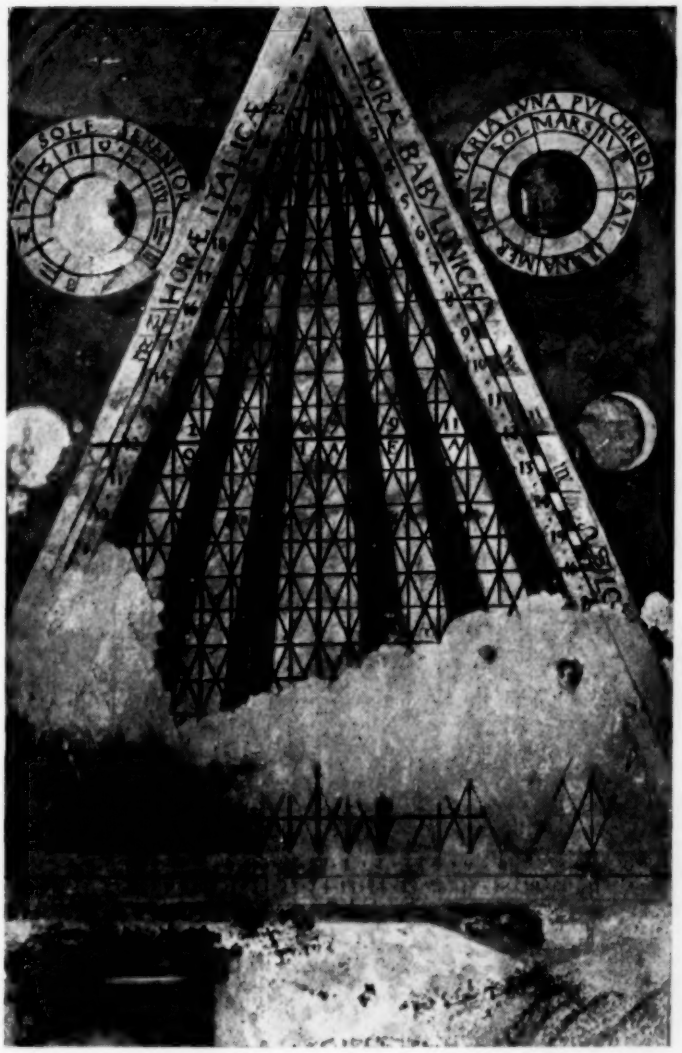
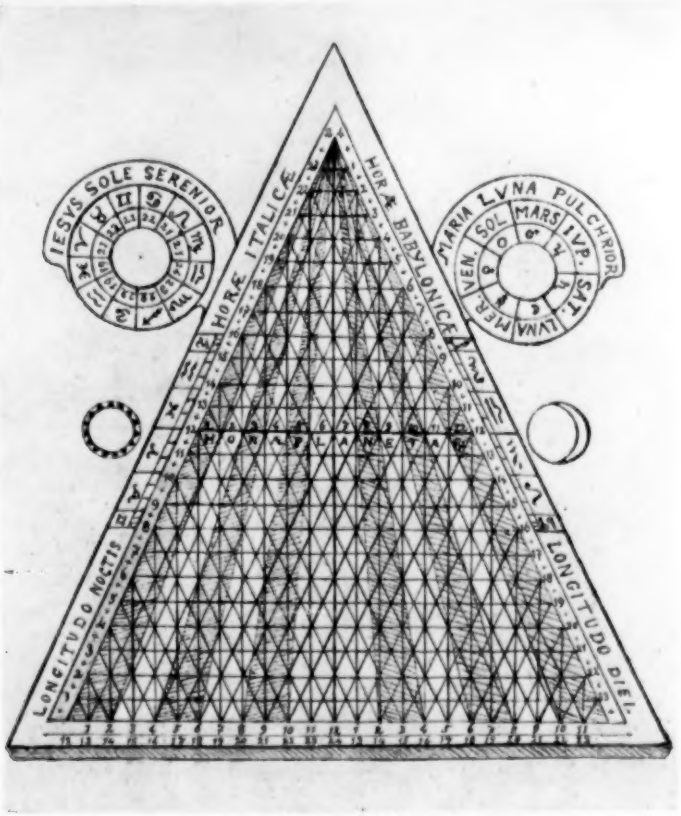
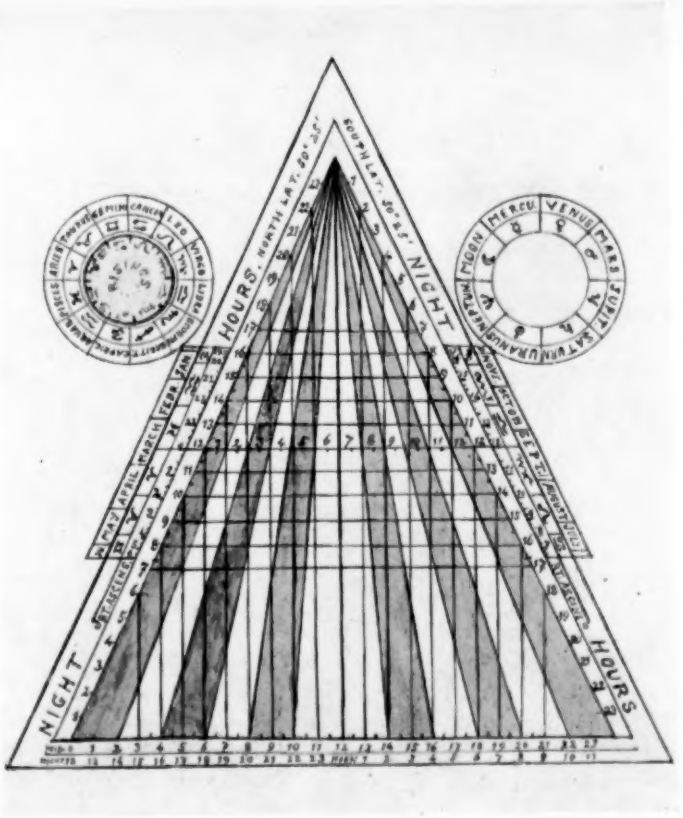


Fig. 1. — Weingarten Planetarium.
(*Phot. G. Lichtel, Munich.*)



Isis, VIII, pl. 13.

Fig. 2. — Restoration.



H. G BÉVENOT.

Fig. 3. — Reconstruction.

best to call it, this scheme can easily be made very practical for the modern student of the heavens. Its study also throws sidelights on the mechanism of the skies which are not without value.

The astronomical device in question is no astrolabe with its complex circles, but merely a large triangular figure, one of the astronomical wall-paintings that adorn the late-Gothic cloister of Weingarten Abbey, near the Lake of Constance (1). After being suppressed for the last hundred years, the Abbey was re-opened in 1922 by Benedictine monks who had long been in England, at Erdington Abbey near Birmingham. The deciphering and reconstruction of these half-effaced geometric figures with quaint devices was undertaken at first chiefly out of monastic and archeological interest; but as the full purport of the paintings gradually revealed itself in the course of long weeks, not to say years of study, it became clear that they were constructed on scientific principles. The paintings are three in number; the oldest (which might well be of the sixteenth century) has in its central part a long rectangle with three small triangles beneath, and above there rest upon it a set of concyclic semi-circles, with the earth at the centre and the moon, Mercury, Venus, the Sun (!) and the three other known planets each in its orbit. The (apparent) time of revolution of the sun is given with laudable precision as 365 days, 5 hours, 49 minutes. (Possibly *seconds* were marked, but they have crumbled away.) This is however not particularly remarkable, as the Spanish Alphonsine tables, of about 1250, already gave the length of the year as 365 d. 5 h. 49' 24".

The next figure in the following arch of the cloister, is an « Easter Calculator » according to the Gregorian reform, and so dates probably from the seventeenth century. Its outermost circle measures six feet in diameter, and by means of a revolving pointer (long since lost) it was possible to read off the Easter moon for the 19 years of the lunar cycle (2). Originally, the diagram may have worked on Julian lines, and have just been « reformed » with the calendar, so it may really be an ingenious device of much longer standing. This may

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(1) To be accurate, Weingarten lies 16 miles north of Friedrichshafen, where the « Los Angeles » dirigeable was constructed.

(2) This « Easter Calculator » I have described in German, in the *Benediktinische Monatschrift*, July, 1923, Beuron; and in English in *The Month*, April, 1924 (London).

be true too of the *third* figure, namely the large triangle in the next arch, which is the main subject of our paper.

The actual triangle is shown in our Fig. 1. The lower portion of the wall-painting has suffered considerably, yet just not to such an extent as to make reconstruction impossible. Fortunately most of the numbers along the base are still legible, for they are equally important with the signs of the Zodiac along the sides of the triangle. These signs are also by no means intact, yet enough remain to establish in what order they were meant to follow one another. Quite undamaged is the central inscription « HORAE PLANETARUM ». But how are the planets to be represented in a triangular sky? And what exactly is the purpose of the twelve rays converging to the apex of the triangle?

The solution is simply this : our Planetarium is a transformer of Zodiac planetary time into ordinary hours of day and night *throughout the year*. It also served a subsidiary purpose that will call for notice.

The two expressions « HORAE ITALICAE » and « HORAE BABYLONICAE » written along the upper sides of the triangle arrest one's eye at first glance. There are twenty-four hour-divisions marked off and numbered along both sides of the triangle as well as along the base. The counting along the base can be either taken from 1, 2, 3, to 24, or made in two sets of twelve. In the former case the reckoning can be made from midday to midday, after the example of Ptolemy and all subsequent astronomers, or from midnight to midnight. The first hour of any day was considered usually to begin thus at midnight. A very curious astrological manuscript that was acquired for Weingarten Abbey in 1628, (now in the *Landesbibliothek* at Stuttgart, H. B. XI., 28) also bears this out. Here there is for every day of the week a large clock-like figure, with the twenty-four hours marked round in a circle, the spaces for the hours being coloured consecutively with the seven colours of the sun, moon and five planets, beginning anew at the eighth, fifteenth and twenty-second hour. This is merely a scheme for casting horoscopes and « nativities », but the point of interest for us is that midnight is the starting-point for the twenty-four hours. So is it also in a MS. written at Weingarten in the 15th Century (*see* p. 308) where there is a set of tables for dividing the day into twelve equal parts throughout the year, given the time of sunrise. The first entry is when the sun reaches Aries, and there sunrise is put at 6 o'clock, so the reckon-

ing is evidently from midnight. We shall have to deal in detail with this MS. below. But first we must explain our restoration of the figure (Fig. 2).

II. — Structure of the Triangle.

If we start from the lower left-hand corner and count up the side of our triangle we get twenty-four hours of « HORAE ITALICAE ». Now these denote the old method of reckoning from sunset to sunset formerly used in Italy and Bohemia. Consequently all the night hours come first. To be practical, let us deal at once with the hour marked 16. We note that the signs of the Zodiac reach up as far as this from the central horizontal line, just as they go down below it as far as hour 8. This indicates that such is the range of variation for the length of the night provided for by the figure. When the night is 16 hours long, the time of sunrise will be (approximately) 8 o'clock; and if we follow the vertical line down from 16 to the base, we do find it numbered 8. Rising four hours before midday, the sun will set (approximately) four hours after, at the hour 16, or 4 p. m. (according to the double-hour-numbers provided in the old figure itself). The sun then occupies as it were the central position of honour, with half of the night on either side. If now we follow up the 4 p. m. line (time of setting) to where it meets the right-hand side of the triangle, we see that point is numbered 8. This is perfectly correct, for it shows the *day* in 8 hours long, and as the « HORAE BABYLONICAE » began the day with *sunrise* (according to the Chaldean and modern Greek method), we see that their ordering of the twenty-four hours is provided for, with beautiful symmetry, down along that right-hand side of the triangle. These modes of reckoning are now antiquated, but I hope to show, in connection with Fig. 3, that the symmetry here provided may still be turned to advantage.

Turning now to the rays emanating from the apex of the triangle and forming the background for the network of lines, we observe that they are twelve in number and that they are distinguished by the figures 1, 2, 3, 4, ... to 12 along the central horizontal line. Furthermore they extend right to the base where, naturally enough, two hours of the twenty-four fall to each ray. These divisions graphically represent the twelve signs of the zodiac, which (apparently) circle round every day and in which the planets move to and fro. Thus, so far as *time* is concerned, the whole sky is laid out

flat by a kind of map-projection, and the time-values of the distance of Zodiac signs and any planets there from each other can be read off the base line. The *specification* of the signs will depend in the first place on which one is occupied by the sun.

Such is the skeleton structure of the planetarium, which we hope is now clear. We now pass over to consider the more delicate parts that are, as it were, the flesh and bone of the figure and make it a living thing.

As mentioned above, the actual symbols of the Zodiac are inscribed six on one side and six on the other of the triangle. By inspection we see that the topmost symbol on the left is Capricorn, which the sun enters when the night is longest, on December 21st (or 22nd). Further down we see Aries, which the sun enters at the spring equinox, so the sun obviously moves down that side of the triangle during the first six months of the year (strictly between Dec. 22nd and June 22nd), *i. e.* till the shortest nights are reached. Returning now to Capricorn, when the night is longest, we observe that the hour-number against it is 16, and this is precisely the length of night generally considered the longest by astronomers and clock-makers for the whole of south Germany. Strictly speaking it is only quite correct for latitude 48° 32', as had already been stated by PTOLEMY in his *Almagest* (book II, chap. 8), in connection with his tables for the rising of the signs of the Zodiac at the mouths of the Borysthenes, or Dnieper. Here, as also in chapter 13 of the same book, PTOLEMY works out angular distances of the signs of the zodiac, which have practically no bearing upon our figure. It should be noted however that even as PTOLEMY deals with every 10 degrees of each sign (which has of course in all thirty), so also are the signs of the Zodiac on our figure divided into three parts (in the space below each one). The latitude of Weingarten is really 47° 40', so that the figure is not correct to the second here, but the difference is really negligeable (1). PTOLEMY himself found it amply sufficient to work out his tables from half-hour to half-hour of increasing length of summer day (*i. e.* latitude). For one degree of latitude even, the difference is slight indeed. Remembering that the horizon is so often hazy, and making allowance for refraction and for the

(1) It should also be noted that PTOLEMY's text itself sometimes states that the night of 16 hours is for latitude 48°, with no mention of minutes.

equation of time (which will affect the finding of our diagram by a few minutes at times), we may be content to have here a prompt and very approximative means of ascertaining our planetary data.

The figure, we may then say, will do excellent duty, for any latitude between 47° and 49°; that is to say for Paris and central France, for Quebec and the northern frontier of the States and for Vancouver Island. In our figure 3 we have slightly expanded the signs of the Zodiac so as to provide for Greenwich latitude (where the longest night is 16 1/4 hours) and in general for latitudes between 50° and 52°. This will also do duty for most of southern Canada.

The reader who lives *south* of 47° or *north* of 52° will be able to benefit from the remarkable adaptability of our planetarium for any place within the limits of the arctic and antarctic circles. He has only to ascertain the precise length of his longest winter nights and shortest summer nights and paste a slip of paper over the six Zodiac signs on each side of the triangle, and sketch them in a more contracted or more expanded form, so that the topmost sign on the left (Capricorn) just reaches the required number of night hours. The lowest sign will lie almost symmetrically below, and the other six signs symmetrically on the right hand side.

To complete our description of the original design we observe that there is a figure of the sun on the one side and of the moon on the other side of the triangle. They are at either end of the central horizontal line which give the equinoxial time. Above the sun are some concentric circles and above them the graceful inscription « JESUS SOLE SERENIOR », while above the moon and other circles we read the parallel motto « MARIA LUNA PULCHRIOR » (« Jesus is more serene than the sun; Mary is fairer than the moon »). The circles above the moon merely give the planets with their symbols; while in the left-hand set of circles, we have important data : the signs of the Zodiac together with the date on which the sun enters each of them.

We now realise that the old-time monks needed but to glance at their diagram any day to note : 1° how far the sun had progressed in any sign of the Zodiac; 2° the time of sunrise and sunset, and consequently 3° the time of rising and setting before or after sunset of any planet in any other sign of the Zodiac. Thus at the beginning of the year with the sun in Capricorn and rising before 8 a.m., it is clear that the Zodiac streak 4 that reaches the base from 6 to 8 represented Capricorn, the other signs being spread out on either side.

Those to the right rose later and those to the left earlier than the sun, and at the times as given at the base. It is particularly to these numerals that the « Horae Planetarum » inscribed along the centre really refer. As to the *signs* themselves, it is clear the monks did not thereby understand precisely the *constellations* (of Capricorn, Aries, etc.), but the series of twelve arcs of 30° into which the ecliptic was divided, starting from the vernal equinox for Aries, as the whole structure of the triangle shows.

Such was the astronomical use of the figure; but it had also *astrological* and *liturgical* uses, which call for mention. As noted above astrology was considered very generally as a sound subdivision of astronomy, so even *a priori* one could not deny that the astronomical findings of our triangle were used for unscientific prognostications. We know however that the monks of Weingarten had bought in 1628 the manuscript Stuttgart, H. B. XI. 28 mentioned above (p. 302) with its astrological values for each hour of the week, day by day, each hour being a « hora planetae ». Furthermore another XV. century MS. (Stuttgart, H. B. XI. 27), which was actually written at Weingarten (1), calls for consideration here : — It is indeed typical of the times. Fol. 1-4 defines astrological terminology and explains abbreviations. Fol. 5r.-6r. gives a « *Tabella signi et gradus ascendentis qualibet hora atque minuta ad medium sexti climatis, cuius latitudo est* ♌ $\bar{\eta}$ *gd.* » (that is 45°). In these tables for every single degree of solar motion in the ecliptic we are given the « ascendens » value of some other sign, at *such* a time p.m. from which by simple addition one can find what sign is rising or southing at any specified day and hour. That there *was* an interest in doing so is clear from the pages that follow. For continuing we find in fol. 6 v. — 12 r. a « *Tabula Equationum* » with the *domus* and *dignitates* corresponding to each degree of the signs of the Zodiac: and on fol. 12 v. and 13 r. we find a preface in contemporary German (by the same hand) beginning : « If Your Grace wishes to know at any one hour and minute which sign is ruling or rising from the East here in Weingarten, then you have to know on that particular day in which sign and degree the sun is. Find this in the Almanach, and then... etc. »

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(1) This follows from the quotation we give below, and from the identity of handwriting throughout the Mss.

What was meant by the « Almanach » we know, for the monks have bound up together with the very same MS. full astronomical calendars for the years 1489 to 1505 in beautiful early print (1). For each day the positions of the sun, moon and planets are given on a *verso* page, while their mutual relations are given on the *recto* page opposite. Thus for May 1st, 1495 we read :

Maius	☉	☽	♄	♃	♂	♀	☿	☊
	♉	♌	♓	♎	♐	♉	♊	♍
Philippi & Ia. I.	19°28'	18°7'	25°21'	2°23'	19°39'	29°42'	11°10'	15°25'

and on the opposite page :

Aspectus lunae ad solē & planetas							Solis & planetar/ inter se
1495	☉	♄	♃	♂	♀	☿	
		or	*oc*	*oc*	*oc*	*oc*	
I.	□ 2			□ 3			☉ ♂

and so the entries continue down both pages for each day of that month. Thus there was at Weingarten more accurate planetary data than our triangle could supply, as its ecliptic measurements are but by tens of degrees; and no doubt among the thousand early prints the Abbey possessed (now destroyed) there were astronomical treatises of value. Under the circumstances, however, it is almost a vain task to try to trace the *mathematical origin* of our triangle, which owing to its beautiful adaptability to various latitudes is of so universal a character as to fairly defy any research work of this kind. Experts in mathematics of the past at Paris and Munich know of no similar diagram, so far as I could ascertain.

The triangle also served a *liturgical* purpose, that of dividing the actual daytime into twelve « horae artificiales » of equal length, to determine the times of Tierce, Sext, None principally, as also the time of rising at night for mattins : « *octava hora noctis surgendum est* » as ST. BENEDICT had prescribed (*Regula*, cap. VIII). And here our triangle is entirely satisfactory (while as a means of determining planetary risings it neglected the latitude or declination of the

(1) From the Saints'names in these calendars, it appears they were printed for Benedictine houses in the dioceses of Constance or Würzburg.

planet (1). At the winter solstice, for example, it is clear that the horizontal line of the triangle going from 16 on the left to 8 on the right represents the time from sunrise to sunset, *i. e.* the length of the day. This line is itself divided into twelve equal parts by the rays emanating from the apex of the triangle, and if we project these points of intersection down upon the base we see at once the time each liturgical (or « artificial ») hour began. Thus on December 22nd the time for Tierce and Conventual Mass was at 10 a.m., and with the lengthening days it came ever earlier, till in high summer it was at 8 o'clock. The diagram would be accurate enough for the sacristan brother to go by for ringing the bells for office, as also for the brother who had to rouse the community at the eighth hour of the night. Again, a Father hearing the clock strike seven could see at a glance how much time he had left till Tierce, etc. The trellis-work between the vertical lines no doubt came in useful for measuring fractions of hours.

In this instance again, Weingarten was not without its more precise manuscript data. In the MS. we have just been examining the fol. 15 v.-19 r. contain a *Tabula horarum in aequal. diei artificialis*, giving the divisions of day and night into twelve equal parts for every three degrees of the sun's progress along the Zodiac, and the time of sunrise as well. We give below the upper part of one page, as the *tabula* is in some ways closely analogous to our triangle. (The numerals are here modernized.)

Locus Solis S. Gr	Ortus Solis h. mi.	hora ante meridiem						Loeus Solis S. Gr.
		1 a h. mi.	2 a h. mi.	3 a h. mi.	4 a h. mi.	5 a h. mi.	6 a h. mi.	
♈ 0°	6 0	7 0	8 0	9 0	10 0	11 0	12 0	♍30°
3°	5 55	6 56	7 57	8 58	9 58	10 59	12 0	27°
6°	5 50	6 52	7 53	8 55	9 57	10 58	12 0	24°

The opposite *recto* pages give similarly the *horae post meridiem*, and there are also pages for the *horae ante* (*et post*) *mediam noctem*.

(1) It was easy for Honorius of Autun (circ. 1120 A. D.), who lived long in South Germany, to write « Unumquodque signum per duas horas oritur, per duas occidit, et in unoquoque sol triginta diebus immoratur ». But he does not see that his own previous statement « Zodiacus... flexuoso lapsu coelum cingit » makes the conclusion inevitable that some signs will rise in less, and some in more than two hours. We shall deal with this factor in our reconstruction of the triangle. The above quotations are from the *De imagine mundi*, lib. II. cap. 14. Migne P. L. 172.147.

What calls for particular notice is that the position of the sun is given from spring equinox to summer solstice down the left-hand-side column and from solstice to autumn equinox up the right-hand-side column of the same page. The following pages deal similarly with the other six months. Were these columns *inclined* instead of parallel, we would have a disposition of things very like our triangle shows beneath the central horizontal line. The *data* for the hours also correspond. Still the neat disposition of the hours along the base of our triangle remains something *sui generis*, and the figure has besides its important planetary purpose.

The concluding part of this MS. (fol. 19 v., 35 r.) is wholly astrological; but this need not surprise us, as so sound an astronomer as Tycho Brahe still believed in astrology. He even predicted the defeat and death of Gustavus Adolphus, and the prophecy in this case was fulfilled. But, so far as our triangle is concerned, it is remarkable that the figure is in no way astrological, but only astronomical and chronometrical.

III. — Reconstruction and modern Use.

The purely astronomical character of the principles involved in the structure of the diagram becomes the clearer when we turn to investigate its adaptability to our own astronomical exigencies. Fig. 3 shows our reconstruction, which is slightly modified to be correct for Greenwich latitude and omits all cross-lines not needed. At Greenwich the sun rises on December 21/22 at 8.5 a.m. and sets at 3.50 p.m., giving thus a day of 7 h. 45 m. and a night of 16 h. 15 m. Hence the extremity of the sign of Capricorn, on the left side of the triangle (as also the end of Sagittarius on right) must reach up to this hour-value. Similarly the sign of Gemini below should reach down between 7 and 8, the shortest June nights being not 8 h. but 7 h. 26 m. The sun then passes into Cancer at the same level, on the opposite side of the triangle. On this right-hand side the hours of the night are obviously correct as given, for the same latitude *south* of the equator. The inhabitant of those southerly regions will still be able to use our diagram, only he must count his twenty-four hours along the (upper) base line as from midday to midday. Midnight will then be in the centre, and the night will be spread out equally on either side. This is, if anything, an advantage, as the astronomer's interest mostly centres in the night hours.

In the original diagram the space allotted to each sign is marked off into three parts. We have preferred to mark off every half-hour of the sun's right ascension (R. A.) in correspondence with the length of the day, beginning with March 21/22, when the sun enters Aries. We also insert the names of the months, so as to make the whole structure perfectly intelligible. In the concentric circles to the left we give the symbols of the signs of the Zodiac, as in the original, but have added besides their names, and in the innermost circle have expressed the absolute time (or duration) of rising of the various signs of the zodiac (1). Particularly for a latitude so far north as ours, the difference is really considerable, and especially for the signs where ecliptic and equator cross. Thus Aries and Taurus together rise in two hours, instead of each taking that time. On the other hand Virgo and Libra take each two hours and a third. All this becomes clear if one considers the right ascension of these constellations and the sharp angle the *horizon* makes with certain parts of the ecliptic. It is all a question of curvatures.

In the sky the signs follow each other anti-clockwise, a least as seen from our northern hemisphere. A glance however at the original left-hand set of circles, shows us they have been inscribed clockwise. We have adopted the same order, as this is helpful to « visualise » the figures 1, 2, 3, 4, ... 11, 12 across the centre of the figure, for here the signs follow from left to right.

We have brought the right-hand circles up to date by inserting Uranus and Neptune, with their symbols. We cannot of course provide for the nine hundred odd minor planets. Finally we have given a double numeration of the hours at the base of the triangle. The upper line, with the twenty-four hours reckoned from midnight, follows the new system adopted in the *British Nautical Almanach* (since 1925); while the lower line gives the ordinary astronomical hours.

In conclusion we add a few practical applications of our improved scheme, which will serve to test it and also render clear anything the reader may possibly have found abstruse in our above exposition. The author also gladly registers here his obligations to Dr. ZINNER, of the University Observatory, Munich, and to his friend Rev. Abbé A. ROME, of Paris, for very helpful suggestions.

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(1) PTOLEMY had already worked out such tables *Almagest*, II, 8.

IV. — Practical Applications.

Problem I. Given that Uranus was in the middle of Pisces with very little apparent notion during the whole of 1923, to find the time of the rising and setting of the planet about the tenth of August.

Solution. Our figure shows that the sun was then in the middle of Leo (R. A. 9 h. 15 m.). This position is a trifle above the horizontal line numbered 15 on this side and 9 on the opposite left-hand-side of the triangle. From the points nine and fifteen we drop imaginary perpendiculars to the base and see that sunrise, in our case, was just after 4,30 a.m. and sunset just before 7.30 p.m. The broad ray at the time of sunrise is the one numbered 3 at the centre. This then will stand for Leo. If we now count round clockwise in our upper circles to the left, from Leo onwards, we find Pisces is seven signs way. The inner circle of signs shows us however that from the middle of Leo to the middle of Pisces the difference in time of rising in our latitude is more than seven full signs of two hours : in fact it is 7 3/4. Hence in our triangle we need ray 3 + 7, that is ray 10, which we see begins to rise at 6 p.m. Its third quarter rises at 7.30. We now recall that the sun was not in the centre of ray three at sunrise but only a third distance in it. So we must subtract a sixth of a ray, *i. e.* a sixth of two hours, or 20 minutes from our above result, and finally have Uranus rising at 7.10 p.m. This is approximately 20 minutes before sunset. Hence Uranus will be visible (with a good telescope!) from sunset to 4.10 a.m.

Problem 2. On Dec. 1st, 1923, Venus was just entering Capricorn, Was the planet visible, and for how long?

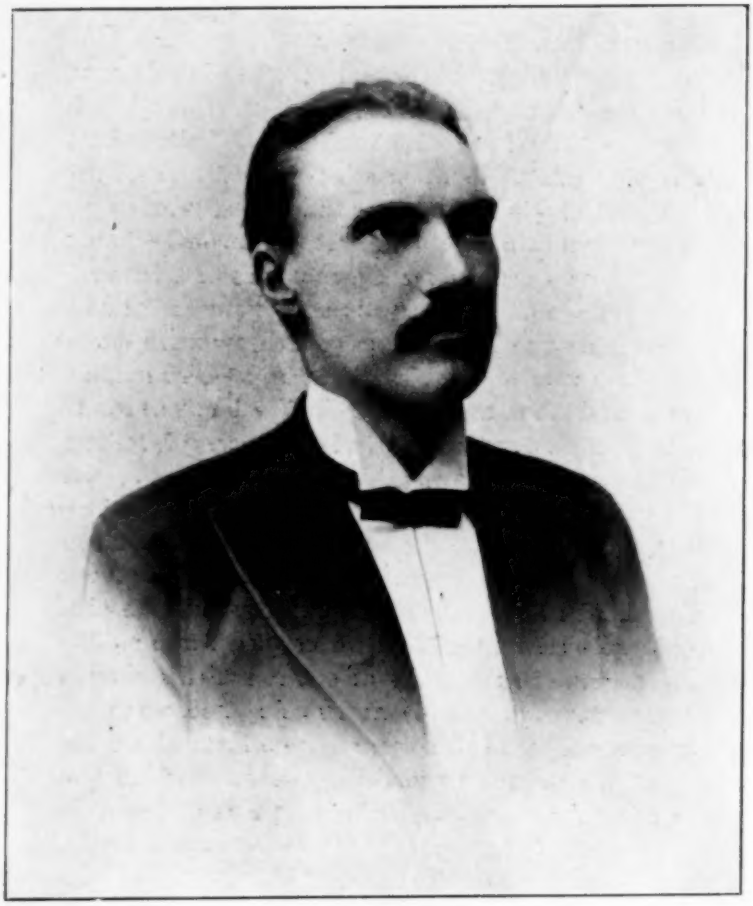
Solution. Our triangle shows that at the end of November the sun is in the middle of Sagittarius, which is the sign before Capricorn. Our small circle to the left shows us that Sagittarius takes two hours and a quarter to rise, so there will be half that amount between the times of setting of the sun and Venus (in this case obviously an evening star). From inspection we see the sun sets at 4 p.m., consequently Venus will set at 5.7 p.m.

Problem 3. About March 21st, 1923, Jupiter was in the middle of Scorpio (*i. e.* as our figure shows, its R. A. was 14 h. 45 m.). When did it rise and set?

Solution. The sun was entering Aries. At the base we see it rose at 6 a.m. and was entering ray 4. Our small circles show that Scorpio is the seventh sign from Aries, and that from the first point

of Aries to the centre of Scorpio (as far as risings and settings are concerned) we have 8 sets of two hours. Consequently Jupiter rises at the beginning of ray 12, that is at 10 p.m. It is visible till sunrise and sets at 10 a.m.

HUGH G. BÉVENOT, O. S. B., B. A.
(*Weingarten Abbey, Württemberg.*)



Gustav ENESTRÖM
(1852-1923).

Isis, VIII, pl. 14. W. Lorey.

Gustav Eneström.

In Memoriam.

Gustav Eneström was born at Nova in Sweden on September 5, 1852, the son of the owner of a coal-mine, and studied at Uppsala, where he passed his « Filosofie Kandidat » examination in 1871. In 1875 he started his career as a librarian and was employed at different libraries. For a short time he was at the Royal Library, Stockholm and in 1920 he became librarian of the Svea hovrätt. In the year 1919 the university of Lund bestowed upon him the degree of a « Filosofie doctor honoris causa ». He died on June 5, 1923, of a nephritic disease.

His colleagues in Sweden do not know much about his private life; he is described as very original and excentric. In any case he lived a very simple and retired life, had never married and found relaxation in music, as his sister wrote to me. Agreable interruptions to the uniformity of his life were his regular travels, especially abroad, which brought him into touch with many of his colleagues. I never had the pleasure of making Eneström's personal acquaintance, but I have often been in correspondence with him and I am obliged to him for much literary advice which he always rendered willingly and as soon as possible. The following words which he wrote as a reply to my congratulations sent on the occasion of his graduation to Filosofie doctor honoris causa, may be quoted to characterize him :

« Für den Glückwunsch danke ich Ihnen bestens, obgleich ich persönlich nicht den geringsten Wert auf die sogenannte « Auszeichnung » lege. » (1)

Already when a student Eneström began to deal with the history of mathematics. In his time no lectures were given on this topic

(1) « I thank you very much for your congratulations, though I personnally do not attach any value at all to the so called distinction . »

in Sweden, and in other countries such were only occasional in the seventies of the last century. ENESTRÖM enumerates the following names in his introductory chapter to the New Series of the *Bibliotheca mathematica* : NESSELMANN (Königsberg), HANKEL (Tübingen), CANTOR (Heidelberg), GÜNTHER (Erlangen-München), FAVARO (Padua), ZEUTHEN (Copenhagen), TANNERY (Paris).

Generally speaking mathematicians were averse to historical research and ENESTRÖM was certainly right when he once wrote (2) :

« Als ich im Anfang der siebziger Jahre anfing, mich mit mathematisch-historischen Studien zu beschäftigen, waren die meisten Mathematiker, mit denen ich in Berührung kam, der Ansicht, dass eingehende Untersuchungen auf diesem Gebiet eigentlich nur unnütze Zeitverschwendung seien, so dass eine solche Arbeit nicht als verdienstlich, sondern als verwerflich erachtet werden müsse. Hat, so sagen sie, eine ältere mathematische Arbeit wirklich bleibende Errungenschaften aufzuweisen, so sind diese gewiss in den neueren systematischen Darstellungen und zwar in verbesserter Form enthalten und das Studium der älteren Arbeit ist also unnütz ; repräsentiert dagegen die Arbeit einen schon überholten Standpunkt, so ist das Studium unnütz oder gar schädlich. »

If mathematicians have now become more interested in the history of their discipline, ENESTRÖM can claim this as his greatest achievement. He himself seems to have been encouraged in the study of old works by some historical remarks which MALMSTEN was fond of putting occasionally in his mathematical lectures. Such occasional hints can be found also in the works of other mathematicians in earlier decades. WEIERSTRASS (3) *e. g.* recommends in his inaugural address delivered on the occasion of his appointment to the rectorship of the University of Berlin on October 15, 1873, the study of the « seldom read publications of scientific societies as well as the

(2) « When in the beginning of the seventies I began to deal with mathematical-historical studies most mathematicians I came in touch with, held the opinion that research in this direction was only a useless waste of time, so that such work could be regarded not as meritorious but rather, derogatory. If an old mathematical work — that is what they said — contains really lasting conclusions they are to be found in an improved form in the modern systematical descriptions and therefore studying an old work seems to be useless; if, however, a work represents an obsolete point of view, the study of it is useless or even pernicious. »

(3) KARL WEIERSTRASS : « Mathematische Werke », Vol. III, p. 336.

voluminous scientific correspondence of the men of science », as very inspiring for the raising of new questions. There may also be mentioned the historical introduction of BERNHARD RIEMANN's habilitation — dissertation (4) handed to the philosophical authorities at Göttingen in 1854 : « Ueber die Darstellung einer Funktion durch eine trigonometrische Reihe » (5), in which he could refer to statements made by DIRICHLET. Besides, it seems as if KRONECKER has sometimes made historical remarks in his lectures; compare *e. g.* his published lectures on definite integrals. An impulse to deal with historical questions is often given to professors by the necessity of delivering a speech at academical festivities. If the topic was of a mathematical-historical character they often used for reference the well known Lectures on the History of Mathematics by MORITZ CANTOR. It is largely due to ENESTRÖM's influence that we regard this work now more critically, but we shall deal with this matter later.

Historical remarks are often made by teachers and lecturers, but that otherwise laudable tradition has caused many errors to be perpetuated even to the present day. For example : the complete induction, the conclusion from n to n + 1, is mentioned in an excellent book, recently published, as a discovery of JACOB BERNOULLI, though it is now well known that this important method was discovered many centuries ago and is to be found already in the works of EUKLID (6). It may sometimes seem hopeless to eradicate such historical errors. Nevertheless I believe that ENESTRÖM went too far when he wished to suppress all historical remarks from the Swedish school-books. His journal brought a very great number of corrections of such historical errors in the Little Remarks to MORITZ CANTOR's Lectures on the History of Mathematics. Many of them may appear pedantic and ENESTRÖM must have felt that himself.

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(4) BERNHARD RIEMANN : Gesammelte mathematische Werke und wissenschaftlicher Nachlass. 2. Auflage, Leipzig. B. G. TEUBNER, 1892, p. 227 - 265. The first 13 pages contain : « The history of the description of a hypothetical function by a trigonometrical series. »

(5) On the description of a function by a trigonometrical series.

(6) G. VACCA. Sulla storia del principe d'induzione completa. *Bulletino di bibliographia e storia delle science matematiche*, Anno XII 1910, p. 33-35.

W. LOREY. Das Princip der vollständigen Induktion. Seine Geschichte und Anwendung im mathematischen Unterricht. *Zeitschrift für math. Unterricht*, 1921. p. 205-209.

His guiding principle, however, was scientific exactitude. Witness the words he wrote on this question in the last volume of the *Bibliotheca mathematica* (7) : « Es kann vielleicht wundernehmen, dass ich mich so ausführlich mit einer Frage beschäftigt habe, die für die Geschichte der Mathematik von sehr untergeordneter Bedeutung ist. Allein prinzipiell ist die Sache leider nicht bedeutungslos. Für die Mathematik ist ganz gleichgültig, ob Bauräte, Pastoren, Apotheker und andere Liebhaber der Mathematik vermeintliche Beweise der schwierigsten mathematischen Sätze veröffentlichen, denn die Fehlerhaftigkeit dieser Beweise wird leicht konstatiert und die Beweise werden ohne weiteres totgeschwiegen. Auf dem mathematisch-historischem Gebiet liegt die Sache dagegen so, dass es zur Zeit keine Angabe gibt, die so unzuverlässig ist, dass sie nicht weiter verbreitet werden kann, und jede tätsachliche Verbreitung einer unzuverlässigen Angabe bedeutet einen mehr oder weniger gefährlichen Angriff auf die exacte mathematisch-historische Forschung, solange sie noch eine ecclesia militans sein muss. »

We find also similar ideas in his last article of the aforementioned volume of 1914 in which he devoted an obituary to Jules Molk, the late publisher of the French edition of the Encyclopædia of mathematical sciences. In this article Enestrom calls him a promoter of exact mathematical historical research. This obituary he finishes with the following request addressed to the productive mathematicians « of whom of course you can only exceptionally expect direct collaboration in mathematical-historical research » : primarily : not to injure the exact research by the further propagation of unreliable statements or by the recommendation of books which contain a great number of such statements; secondly : to promote, as far as possible, the work of exact research.

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(7) « It may seem surprising that I have dealt so amply with a question which is of a very subordinated character in the history of mathematics. But from the point of view of principle the matter has its importance. Mathematics are not affected if engineers, parsons, chemists, and other lovers of mathematics publish supposed solutions of the most difficult mathematical propositions, for the faultiness of these solutions is easily shown and they are dispelled without much ado. In the mathematical-historical sphere, however, the matter stands thus that there is at present no statement which is so uncertain that it cannot be developed further, and every actual extension of an unreliable statement means a more or less dangerous assault on exact mathematical-historical research, as long as it must yet be an ecclesia militans. »

The last volume of the *Bibliotheca mathematica* was the 14ᵗᵉ of the 3ʳᵈ series. This journal had been founded by him in 1884, but the first three volumes were very small and dealt only with bibliography.

The volumes of the second series were also small, being restricted to eight printed sheets, and the journal did not become known to wider mathematical circles until it was taken over in a very enlarged form by the publishing house of B. G. TEUBNER, Leipzig, which had at that time great influence on mathematics (8). As early as 1887 ENESTRÖM had inquired in a letter to B. G. TEUBNER, dated March 18, if he was prepared to take over the publication on commission of the *Bibliotheca mathematica* which had been published up to that date in Stockholm and Paris. In the same letter he also proposed the combination of his journal with the litterary-historical department of the « *Zeitschrift für Mathematik und Physik* », edited by SCHLÖMILCH which had existed since 1875 under the management of MORITZ CANTOR. TEUBNER agreed to take over the publication on commission; the suggested combination he treated in a dilatory manner. The matter did not progress and it was not until April 18, 1899, that the publishing house wrote to ENESTRÖM asking him to accept the editorship of a new journal on the history of mathematics including geodesy and astronomy but to give up the *Bibliotheca mathematica*.

ENESTRÖM had great objections to extending the programme; however, he was not averse to the alteration of the title *e. g.* to Philomathesis. The negotiations soon resulted in the journal being published by B. G. TEUBNER under the old title but in a new very enlarged form. The contents of the thirteen and fourteen volumes of the *Bibliotheca mathematica* represent the greater part of ENESTRÖM's scientific work. Its third series especially is a brilliant standard of editorial work with its absolutely reliable bibliographical notes in the register of names and of authors.

Each volume brings contributions by the author : discussions of methodical questions or of special historical spheres of the middle

(8) W. LOREY : Das Studium der Mathematik an den deutschen Universitäten seit Anfang des 19. Jahrhunderts. *Deutsche Abhandlungen der Internationalen mathematischen Unterrichtskommission*. Vol. III, 9, p. 303, Leipzig, B. G. TEUBNER (1916). This commission is usually abbreviated in mathematical circles « Imuk ».

ages or of modern times : treatises or inquiries or the already mentioned Little Remarks upon CANTOR's Lectures on the History of Mathematics.

In the course of years these remarks become more and more polemical. In the first volume of the new series ENESTRÖM still calls CANTOR's lectures « an excellent description, though the bibliographical statements are not always correct ». As time passed these remarks became more and more pointed and in consequence often gave offence, a fact I have already laid stress upon in my above mentioned Imuk-treatise. In his letter of thanks mentioned in the beginning of this notice, ENESTRÖM calls my attention to this article published in the 13th volume : « How to prevent further extension of unreliable mathematical-historical statements? » I have to admit that ENESTRÖM herein justifies his manner of criticism. He shows that CANTOR's errors are not, as he had at first thought, occasional, but that they are systematic errors caused by insufficient mathematical knowledge and by inefficient work. Therefore ENESTRÖM's criticism had led to the following remark written to him by a mathematician and occasional contributor to the Bibliotheca with reference to MORITZ CANTOR : « Sie haben uns unseres mathematisch-historischen Gottes beraubt » (9).

ENESTRÖM's works are not only contained in his *Bibliotheca mathematica* : before 1884 he had published numerous historical treatises in the year-books of the Uppsala university and in the Stockholm academy of science, also autoreferate issued in the *Jahrbuch über die Fortschritte der Mathematik* to which ENESTRÖM was a contributor for more than twenty years. It is much to be regretted that in this important annual the history of mathematics is now scattered and distributed among different collaborators none of whom seems to be a special investigator of the history of mathematics. One must also be grateful to ENESTRÖM for compiling a bibliography of EULER's writings which was of great importance in the publication of the latter's works. It was on ENESTRÖM's suggestion that a « Tribune publique » was added as a supplement to the already mentioned French edition of the Encyclopædia of mathematical sciences. It is due to his influence that the French edition started with a more exact historical-bibliographical character than the German parts published up to date.

(9) « You have deprived us of our mathematical-historical God »

A few days before his death he still helped in the revision of the proofs of a new edition of TROPFKE's « Geschichte der Elementarmathematik », and thus he has done much to increase the reliability of that work.

In the nineties he also busied himself with questions of actuarial sciences and mathematical statistics, as shown by numerous articles in the reports of the Stockholm academy, the Hollandischen *Archief voor de Verzekeringswetenschap* and in the *Abhandlungen zur Geschichte der Mathematik* (Festschrift für MORITZ CANTOR), thus he deals with the method of JOHANN DE WITT for the calculation of life — annuities very often misunderstood in historial descriptions. It is interesting to see how in 1897, ENESTRÖM justly criticised the respective passages in the « excellent lectures of CANTOR » (10).

The articles of a purely actuarial character are predominant and it is in his study of the problem of pension-insurance that he discovers among others a theorem on the roots of an algebraic equation all coefficients of which are real and positive. This theorem is known by the name of the Japanese mathematician KAKEYA. ENESTRÖM's last work seems to be the French publication of his theorem in a Japanese mathematical journal, though it was originally written in the Swedish language (11).

ENESTRÖM was, as his sister writes to me, master of many languages not only European. His box for alphabetically arranged slips, is well known and among his colleagues it is to be hoped that the enormous material contained in it will be kept in order and made accessible to investigators. It has been presented by his sister with all his property to the Stockholm university. A list of all ENESTRÖM's historical-mathematical publications is contained in the 4th, and the 5th volume soon to appear, of the famous biographical-literary hand-lexicon on the history of exact sciences founded by POGGENDORFF.

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(10) Sur la méthode de JOHANN DE WITT (1671) pour le calcul de rentes viagères, *Archief voor de Verzekeringswetenschap*, Deel III, Afl. 1.

(11) Remarque sur un théorème relatif aux racines de l'équation

$$a_n x^n + a_{n-1} x^{n-1} + \ldots a_1 x + a_0 = 0$$

où tous les cœfficients a sont réels et positifs. *The Tohoku Math. Journal*, 1920, vol. 8, 34-35. Also *Jahrbuch über die Fortschritte der Math.* (25), 1893-1894; page 360.

A tremendous amount of papers were written by this diligent, conscientious, and ingenious investigator, who had a leisure given to few, and who had been able to acquire a special library that contains, as WIELEITNER supposes, at least as many volumes as that of Mr. CHASLES. Unfortunately ENESTRÖM did not possess the gift of imparting knowledge (12). But nevertheless his name will live as the first really critical investigator of the history of mathematics.

I have to express my thanks for the material placed at my disposal for writing this obituary notice to the librarian of the Royal Library in Stockholm, Mr. S. HAUBUG; to the general director of the Lifforsäkrings Aktiebolaget Thule in Stockholm, Mr. PALME; and to Miss EMMY ENESTRÖM who also gave permission for the reproduction of her brother's portrait. Other portraits of ENESTRÖM are contained in *Isis*, vol. V, p. 421 and in *Bibliotheca mathematica*, 2nd series, General-Register 1887-1896, in which the editor also gives short biographical notes of all contributors with their pictures. I cannot conclude without expressing my deep sense of obligation to the publishing house of B. G. TEUBNER for permission to read its correspondence with ENESTRÖM.

W. LOREY.

(*Leipzig.*)

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(12) *Unterrichtsblätter für Mathematik und Naturwissenschaften. Jahrgang* XXX (1924), p. 19. Two short obtuary notices were written by CAJORI in *Science*, Vol. LIX, 1924, p. 10, and by LORIA in the *Archivio di Storia della Scienza*, vol. IV, 1923, p. 407-408. See also *Isis*, V, 421, a notice by G. SARTON, with portrait.

W. W. R. BALL
(1850-1925).

Walter William Rouse Ball

Not only students of the history of mathematics but mathematical readers in general are familiar with the writings of Walter William Rouse Ball. Among Englishmen he ranks as a pioneer author on the general history of mathematics. The activities of Augustus De Morgan, Isaac Todhunter and J. W. L. Glaisher in the field of mathematical history are limited to special topics and are based upon the study of original sources. This careful examination of source material becomes impossible as the regular mode of procedure to one who undertakes single-handed to write the history of a science like mathematics from the earliest times to the present. Such an history must necessarily be to a large extent a compilation. Mr. Ball possessed one most important qualification for such a task, namely, a most engaging style. More than any other writer of his time did he understand how to please his readers by well told anecdote, or a bit of interesting gossip. These qualities stand out conspicuously in his two most important general books, his *Short History of Mathematics* which first appeared in 1888 and his *Mathematical Recreations and Problems*, first brought out in 1892. Both books have gone through many editions, and are widely read.

Ball was born on August 14, 1850, at Hampstead, London, and died on April 4, 1925, at Elmside in Cambridge. He was educated at the University College School and at University College, London. In 1869 he graduated with honors in philosophy and mathematics, and the following year he commenced residence at Trinity College, Cambridge, where in 1874 he attained the high rank of second wrangler in mathematics, G. C. Calliphronas being placed first. In the same year Ball came out first in the Smith's prize examination in mathematics. In 1875 he was elected to a Fellowship at Trinity College. At this time he also studied law, and later was called to the Bar by the Inner Temple. He never practised much, but he wrote a *Student's Guide to the Bar*, and as late as 1925 *Who is Who* represented him as a « barrister ».

When in 1877 W. K. CLIFFORD who held the chair of applied mathematics at the University College, London, broke down in health, BALL was appointed in his place. The next year he became lecturer at Trinity College, Cambridge, where for the rest of his life, he devoted himself to the duties as a tutor, to the internal affairs of this College, and to the writing of his historical works. The obituary notice in *Nature* of May 20, 1925, and the longer notice in the *Mathematical Gazette* of October, 1925, by Professor E. T. WHITTAKER, give emphasis to the important place which BALL occupied in Trinity and the great popularity which he enjoyed.

His first historical study was a pamphlet, *The Origin and History of the Mathematical Tripos*, 1880. In 1888 appeared his *Short History of Mathematics*, to which allusion has already been made. In this, no attempt was made at a philosophical exposition of the subject nor at a painstaking presentation of the evolution of mathematical concepts and theories. But it contained a delightful account of what a young student of mathematics or most general readers interested in this science might wish to know. In the preparation of general histories of mathematics, BALL and the present writer worked nearly contemporaneously, but BALL appeared in print first. The present writer began compiling his history of mathematics in New Orleans in 1886, but it did not appear from the press until 1894. In the case of the elementary histories, again BALL was the first to publish. His *Primer of the History of Mathematics* bears the date of 1895, which was one year earlier than my elementary history. The first editions of BALL's two histories of mathematics appeared before the advent of the critical school in mathematical history under the leadership of the late GUSTAV ENESTRÖM of Stockholm, which endeavored to impress the desirability of extreme accuracy in every historical detail. Nor did BALL give evidence of having been a close reader of MORITZ CANTOR's four great volumes, the *Vorlesungen über Geschichte der Mathematik*. It would seem that his historical studies were carried on quite independently of Scandinavian and German influences. ENESTRÖM was first of all a skilful bibliographer; BALL never was active in that field of mathematical historiography. To non-German readers CANTOR's style seems ponderous; it was presumably unattractive to BALL, the master entertainer and story teller. To ENESTRÖM's historical Journal, the *Bibliotheca Mathematica*, BALL contributed only two short articles. The first article of 1891, was on « NEWTON's classification of cubic curves »; the second of 1894,

pointed out the occurrence of the Greek letter π for the designation of 3.14159... in a book of WILLIAM JONES, published in 1706. However, BALL wrote several articles for the *Mathematical Gazette*, foremost of which was the one of July, 1912, on « The Cambridge School of Mathematics ».

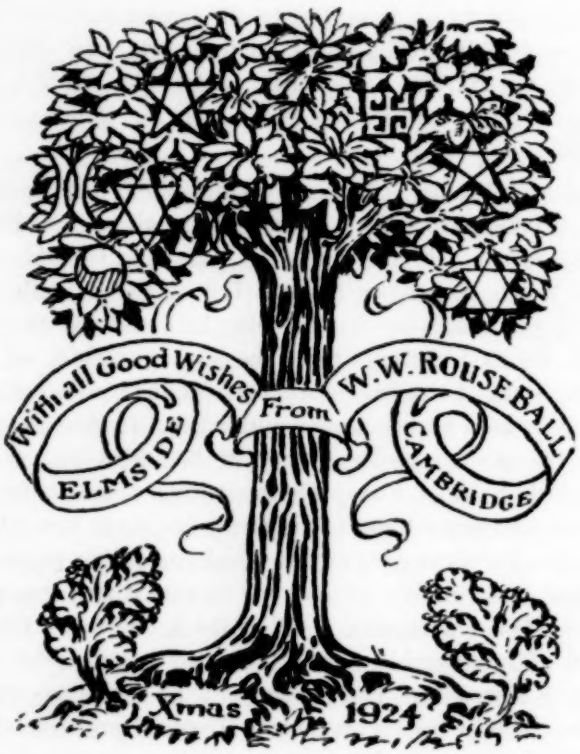
BALL enjoyed an advantage over many other historians of mathematics in residing where there are very unusual library facilities for historical research. It is doubtful whether he took full advantage of the facilities at Cambridge, except in his book on the *History of the Study of Mathematics at Cambridge* (1889) and his *Essay on Newton's Principia* (1893). He was very fond of tricks, puzzles, games and of all works of arithmetical and geometrical pastimes. These he collected in what is the most unique and most widely read of his books, the *Mathematical Recreations and Problems* (1892) to which we have already alluded. It has no equal in the English language. BALL was interested also in making a collection of portraits of mathematicians which is said to be the largest collection of this sort in Great Britain and, perhaps, in the world. In 1914 it was exhibited at the NAPIER Tercentenary Celebration in Edinburgh. A catalogue of the portraits was printed in the *Handbook to the Napier Exhibition*.

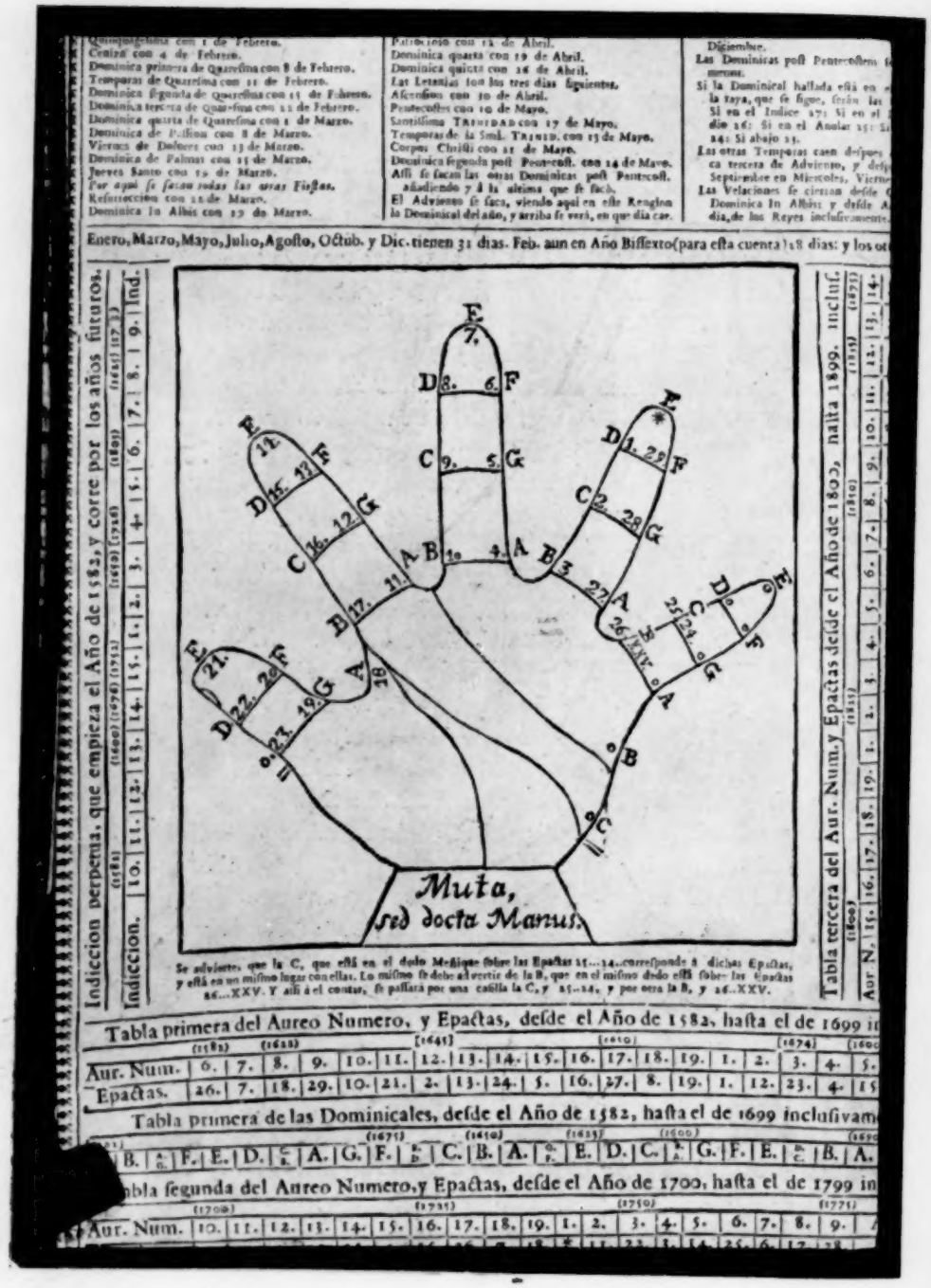
It was at the NAPIER Tercentenary Celebration that the present writer was privileged to make the personal acquaintance of BALL and to enjoy the charm of his personality. Again later in 1914, at Cambridge, the writer was shown through Trinity College with its fine Library, enjoyed hospitality at the dining hall, and was also invited to Elmside, BALL's home. At that time BALL was saddened by the news of the death of Cambridge students who had early entered the war, some of whom he had known intimately. In December, 1924, BALL sent the present writer a copy of the third edition of his delightful little book on *String Figures* with a note : « Here is an advance copy of a new edition of my *String Figures*. It wont be put on the market for some months, but I had one or two copies struck off for myself and venture to send one in case it may interest you. It includes a few new figures. » With the book came a Christmas card struck off, presumably, from BALL's own design, which we take the liberty to reproduce. The greetings of the season are expressed in words and also by mystic mathematical symbolism, some of which originated in Pythagorean days.

That BALL's deep interest in mathematical history continued to his last years, is evidenced by his contribution of funds to the University of Cambridge, for the establishment of an annual lecture on some topic relating to the history of mathematics. The first lecture, « The Rouse Ball Lecture for 1924 », was delivered by HORACE LAMB on « The Evolution of Mathematical Physics ». May this lectureship assist to keep green the memory of a delightful personality of wide influence in creating a love for the history of mathematics and in demonstrating how the art of entertainment may be elevated to intellectual levels above the din and dissonance too common in modern times.

FLORIAN CAJORI.

University of California.





Isis, VIII pl. 16.

F. CAJORI.

A notable Case of Finger-reckoning in America.

A notable Case of Finger-reckoning in America.

In this article I distinguish between finger-reckoning and the mere indication of numbers by the outstretched or bent fingers. The latter practice seems to have been widely prevalent and still persists. Computation on the fingers was in vogue, more or less, among the Greeks and Romans, but was gradually abandoned in Europe after the sixteenth century, except in Roumania and in isolated places among the French peasants (1). Traces of it are found also in the United States in a few very small foreign settlements. It is the purpose of this paper to call attention to an American booklet of the eighteenth century which uses the fingers of the left hand in the computation of the dates of feasts in the Christian calendars. I have not been able to find this very specialized process of finger-reckoning in European authors. The booklet in question, covering thirty pages, was brought out in the City of Mexico in 1757 by a priest, Buenaventura Francisco de Ossorio, under the title *Astronomica, y Harmoniosa Mano*. It is dedicated to Antonio Gamboa, y Ryaño, professor of mathematics in the University of Mexico. There are two copies of it in the Bancroft Library of the University of California, and my attention was called to them by Professor H. I. Priestly. Judging by the statements in the dedication of the book and in the printing privilege, the process was original with Ossorio. In the adjoining illustration the astronomical and metrical Hand — the « mute but learned hand », — is reproduced. For the determinations of the dates of feasts, two fundamental data are taken from the tables placed on the border of the large sheet on which this Hand is drawn. In the figure given here, there is reproduced only a part of the border. One of these data is the Sunday or *dominical* letter of the year under consideration — one of the seven

(1) P. Treutlein, *Abhandlungen zur Geschichte der Mathematik*, Vol. I, Leipzig. 1877, p. 21.

letters A, B, C, D, E, F, G. In every year, January first was marked A, January second was marked B, January third, C, and so on. The letter which in a common year falls on Sunday is the dominical letter for that year. A leap year has two dominical letters, one for January and February, and the preceding letter for the remaining months (G being taken to precede A). The second of these data is the number, called the *epact*, which, in the new style of the calendar, means the age of the moon on the first of January; it is one of the numbers 1, 2, 3, ..., 29 (2).

Suppose we desire to know on what date Easter Sunday came in the year 1735. From the tables bordering the Hand we find that the dominical letter for that year was B, the epact was 6. Having these data one proceeds by using the astronomical Hand. All the capitals drawn upon it are dominical letters; all the numbers are epacts. Find the place on the Hand marked 6. It is on the middle finger. From this 6 move along the finger-edges toward the right till the letter B is reached; this is at 3. From the marginal data we learn that, to find Easter, we must always begin with March 22. We start at the point 22, on the thumb, and advance toward the right, following the outline of the fingers and counting « March 23 » when we are at 21, « March 24 » when we are at 20, and so on. When we arrive at 3 we shall have reached « April 10 ». This was the date of Easter Sunday in the year 1735, new style.

If one wishes to find Ascension day for 1735, use the same position 3 on the Hand. The marginal data show that we must begin with April 30. As before, start at 22 and when 3 is reached, you will have counted to May 19, which was the date of Ascension day in 1735. This same process was used for over thirty movable feasts in the Catholic calendar. In all cases the chart supplies the dominical letter and the epact for the year in question; it supplies also the initial date used for finding the particular feast. Our aim is simply to show how the Hand was utilized in finding the dates, not to explain the Gregorian calendar.

In case of a leap year, say 1928, the dominical letters are A and G, the epact is 8. To find the date of Easter Sunday, one begins as before with March 22. March has the dominical letter G which is

(2) The reader will recall that since the time of GAUSS and DELAMBRE, the use of CLAVIUS' tables for finding the dominical letter, the epact and the golden number has been superseded by formulas of calculation independent of tables.

located at 5. Starting on the Hand, as before, at 22 and counting dates as we pass, we obtain April 8 as the date of Easter Sunday in 1928 (3).

Easter Sunday always falls on March 22 or April 25, or on dates between them. Thus thirty-five distinct almanacs are possible. The dates of feasts given in the marginal tables are correct for all new style almanacs of those years in which Easter Sunday comes on March 22. The Hand is used to ascertain the shift in the dates of all the movable feasts of the thirty four other distinct almanacs. In other words, this Hand removes the necessity of printing the thirty four other almanacs. Augustus De Morgan, in his *Book of Almanacs*, 1851, printed in full each of the thirty five different almanacs arising from the thirty five different dates of Easter Sunday.

Florian Cajori.

University of California.

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(3) On the little finger occur the letter C with two epacts 25 and 24, and the letter B with two epacts 28 and XXV. The use of two epacts 25, 24 is due to the procedure adopted by Clavius of carrying the days of every lunar month formally up to 30 and in the hollow months to reduce this number virtually to 29, by writing two of the numbers, 25 and 24, in the same line. Clavius adopted also a special rule relating to epacts, which made it possible to retain in his reformed calendar a peculiarity of the Julian calendar, namely the peculiarity that no two years in a cycle of 19 years should have the same epacts 25 and 24, and consequently no two years should have any of their calendar new moons on the same days. Clavius observed that it was sufficient to say that the epact is 26 whenever the epact would be 25 and the year of the cycle (golden number) was after the eleventh. According to these conventions in the Gregorian calendar, if the epact is 24, or if the epact is 25 and the year of the cycle is before the twelfth, select the position C on the little finger; if the epact is 25 and the year of the cycle is after the eleventh, or if the epact is 26, select the position B on that finger. See also A. De Morgan, « On the Ecclesiastical Calendar » in *The Companion to the British Almanac for* 1845, p. 22-25.

Notes to the origin of the expression : « Atra Mors »

The origin of the designation *atra mors* which has been given to plague in general and to the epidemic of 1348-1349 in particular, is by no means certainly known. The prevailing opinion is voiced by Cardinal Gasquet (1) according to whom the expression occurs for the first time in the *Rerum Danicarum Historia* of Pontanus published in 1631 (2). After this time, the phrases *den sorte Dod*, the Icelandic *Svatur Daudi* (3), *der schwarze Tod* and *the Black Death* multiply rapidly, designating epidemics of plague, chiefly those of 1348 and 1664. The etymology is considered unclear; according to Gasquet, the phrase refers to the state of universal mourning or to the ominous prognosis, according to Hecker, to some of the symptoms : « black spots » (4); *i. e.* hemorragic pustulae in the septicemic form, most probably.

Cardinal Gasquet's statement, if taken as referring to the name *atra mors* of the epidemic in 1348 exclusively, seems to be correct. If, however, we ask whether the plague or other acute infectious diseases with evil prognosis — after all differential diagnosis was very primitive and exact nosologic classifications should not be expected — ever received the designation, before 1631 we must answer with yes. The name *atra mors* is mentioned in connection with a *Febris pestilentialis* by Gilles de Corbeil (Aegidius Corboliensis) (5) in a poem *De signis et sinthomatibus egritudinum*, sec-

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(1) F. A. Gasquet, The Black Death, London 1908. p. 7.

(2) Johannes Isaacus Pontanus, Rer. Dan. Hist., Amsterdam, 1631, p. 476. : ... notant chronologi adeo saevam ac diram hoc anno pestem... grassatam ... Vulgo et ab effectu *atram mortem* [italics his!] vocitabant.

(3) Saabye, Tagebuch in Grönland, Introd. XVIII.

(4) Hecker, Epidemics of the Middle Ages, London 1844, p. 2.

(5) viz. d'Irsay, Gilles de Corbeil, *Annals of Med. Hist.* VII. 362, 1925.

tion *Signa febris pestilentialis*, extant in one MS (6), published by DAREMBERG in 1853 for the first time (7). The passage in question reads :

Quam subito solet atra sequi mors significabunt
Pestiferam, quisquis legis, hec sinthomata febrem... (8).

Here the connection is evident : the name is given most probably on account of the fatal prognosis. The description given might of course be any acute infectious disease and follows ARETAEUS rather closely (9).

The expression *in se* is certainly very ancient. It occurs possibly for the first time in HOMER :

πλεῖοι μέλανος Θανάτοιο (Od. XII, 92.) The Homeric Θάνατος is the sweet, soothing, silent brother of sleep, descending as « brazen sleep » (10); it is black, because akin to night, but not on account of its horrors (11). Death is not horrible, it becomes so in HESIOD, born from the night together with cruel fate (12) and appearing hand in hand with the prehomeric Κήρ, the unavoidable doom. Death from then on is black in its purple royal dignity (13) *and* in its mercilessness. As such it appears in EURIPIDES (14) and in

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(6) Bodleian, Cod. Can. 455. XIVth C.

(7) DAREMBERG, Notices et extraits des mss. médicaux, etc. Paris 1853, p. 173 sqq. Vv. 401-423 (the Signa febris pestilentialis) are not contained in the Amplonian MS of the whole De signis... published by V. ROSE, Leipzig 1907.

(8) The passage is not mentioned by C. VIEILLARD, GILLES DE CORBEIL, Paris 1909. Discussion of De signis on pp. 70-73.).

(9) viz. ARET. Ac. A' κθ'

(10) χάλκεος ὕπνος, Il. XI, 241. viz. ferreus somnus, VERG. Aen. X, 745.

(11) This is shown also in the designation πορφύρεος Θάνατος Il. V, 83; XVI, 334; XX, 477.

(12) Theog. 211-212 : Νὺξ δ'ἔτεκε στυγερόν τε Μόρον, καὶ Κῆρα μέλαιναν,
καὶ Θάνατον, τὲκε δ'Ὕπνον, ἔτικτε δὲ φῦλον Ὀνείρων.

(13) viz. supra, 11.

(14) Τρῳάδες, 1316-17. Μέλας γὰρ ὅσσε κατακαλύπτει
Θάνατος ὅσιον ἀνοσίαις σφαγαῖσιν.

Sophocles (15), often synonymous with Ἅιδης (16), sometimes as a god, at other times only as poetic personification (17).

In Rome, *Mors* receives the epithet quite often, never as deity (18), but as personified symbol (19), entirely in the Greek sense. In that sense, we encounter *atra mors* in Tibullus (20), Horace (21), Silius Italicus (22), Statius (23) and on various inscriptions (24). Here

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(15) Oed. Rex, 29 : μέλας δ'Ἅιδης

(16) Eur. Ἅιδης [o] ἱ σκοτίας ἀμφέβαλεν πτèρυγας.

(17) Eur. Ion. et *al. loc.* ὁ μελαγχαίτας θεός. viz. on an inscription : τριάκοντα δέ μιν λυκὰβαντας ἀναπλησαντα [δ] όμρασι Μοιραῶν εἶλε μέλας Θάνατος. Amorgos, *Bull de corr. hell.* 15, 604, 1891, No. 44-15. v. Wilamowitz-Möllendorf in *Herm.*, 34, 229. viz, article Thanatos, C. Pauli in Roscher, Lex. d. griech. u. röm. Myth. Leipzig 1918, col. 481 sqq.

(18) viz. R. Peter in Roscher, Lex. d. griech. u. röm. Myth., article mors, II/2, Leipzig, 1894-1897, col. 3218.

(19) J.-B. Carter, Epitheta deorum quae apud poetas Latinos leguntur, Roscher, op. cit. Suppl., Leipzig 1902.

(20) I., 10, 33 : Quis furor est atram bellis arcessere Mortem ?
imminet et tacito clam venit illa pede.

I., 3, 4-5 : Abstineas avidas, Mors precor atra, manus
abstineas, Mors atra, precor..... (Variorum ed. London 1822 and ed. K. F. Smith, New York 1913. According to ed. E. Hiller, Leipzig 1885 1, 3, 4 reads nigra mors.)

(21) Carm., I. 28, 11-13 ; ..... quamvis clypeo Trojana refixo.
Tempora testatus, nihil ultra.
Nervos atque cutem morti concesserat atrae.....

(22) Punica, XIII, 774-5 : .,... tu magna gerendi.
Praecipita tempus; mors atra impendet agenti.

(23) Theb., IV. 528-9 ;
In speculis Mors atra sedet, dominisque silentes.
In a slightly different form :
Annumerat populos : major supereminet ordo.
Theb., I. 594-7 . ..... nec motus et atro.
Imperat infandum ! cupientem occumbere leto,
Sero memor thalami, moestae solatia morti.
Phoebe, paras.....

(24) Carmina Latina Epigraphica, ed. F. Bücheler, Leipzig 1895, I. No. 346 (British inscription) : vv. 3-4.
Legibus inferni motis Proserpina reddi.
Eurydicen iussit, sed eam Mors atra reduxit.
(Viz. *Monthly Mag.* 1825, 59, p. 218.) ibid. II. 1339, No. 626, v. 1-2 : (Inscription on the Quirinal) :
Perpetuas sine fine domos mors incolit atra
aeternosq[ue] levis possidet umbra lares.

then is one source : *atra mors* simply signifying the horrors of death in general. *Ater* is, as it were, used very frequently in a figurative sense to denote ominous, portentous events; certain days *mali ominis* are *atrae dies* (25). And *ater* comes to be the designation of many things connected with Orcus (26), it is the favorite eschatic adjective. But apart from this, another use can be traced which might have given aid to the specific sense we are concerned with. Blood in Greek authors very often is Κελαινός or μέλας (27). This use is continued by the Romans; it occurs in Ennius (28), Livy (29), Statius (30) and many other places (31). But what is more important, some authors use it in connection with descriptions of plague and epidemics of various sorts, — chiefly relying upon Thucydides II, 47-53 of course — particularly Lucretius (32), Vergil (33) and Seneca (34). These describe hemoptysis and hemorrhages of the mucous membranes (sudabant fauces... atrae sanguine : Lucre-

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(25) Verg. Aen. VI. 429 (quos abstulit atra dies); Macrob. sat. I, 16, 21; Prop. II, 11, 4; Stat. Theb. III, 636; VIII, 376; Varro ling., VI., 29 etc., etc.

(26) Comp. Apul., Metamorph., VI. 122 : ..... ante ipsum limen et atra atria Proserpinae semper excutans.....

(27) Hom., Od. II. 41 : κελαινόν αἷμα.

(28) Frag. 310 : saxa spargens tabo,
sanie et sanguine atro.

(29) XXXVIII, 21, 9.

(30) Theb., VI. 211.

(31) Verg., Georg. III, 221; Aen. III, 28; IV, 681; Ovid., Met. XII, 256; Plin. hist. nat. VIII, 49; Sil. Ital. VIII, 644; IX, 153; in legal texts : Cod. Iust. IX, 14, 1, 1; in medical authors : Celsus, De med. II, 8; Cael. Aurel. chron. V, 4, 71 etc.

(32) De rer. nat. VI. 1147-1150 :
Sudabant etiam fauces intrinsecus atrae
sanguine et ulceribus vocis via saepta coibat
atque animi interpres manabat lingua cruore
debilitata malis, motu gravis, aspera tactu.

(33) Geor. III, 505-508 :
Tum vero ardentes oculi atque attractus ab alto.
Spiritus, interdum gemitu gravis, imaque longo.
Ilio singultu tendunt, it naribus ater
Sanguis et obsessas fauces praemit aspera lingua.

(34) Oed. 187a-189 :
..... resonant aures
stillatque niger naris aduncae
cruor et venas rumpit hiantes.....

TIUS; it naribus ater sanguis : VERGIL) and it is very possible that this physical association contributed very much to the designation of the plague particularly when the first source : the fatal outcome is also considered.

I mentioned SENECA. This author describes the plague and in that connection uses the expression *atra mors* (35). It is not used to denote the disease which he is dealing with, but notwithstanding the expression is there, as a personification of that very epidemic disease (36). It is possible then, that with SENECA begins the application of the epithet to acute fatal infections, continuing through GILLES DE CORBEIL and culminating in the XVII^th^ century's restriction of it to one specific disease. Constant consequences are often taken to designate events and processes and the shift from SENECA to GILLES and from GILLES to PONTANUS is thus very easy to understand.

STEPHEN D'IRSAY.

Yale University, New Haven, Conn.

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(35) Oed. 164-170.

Mors atra avidos oris hiatus
pandit et omnis explicat alas;
quique capaci turbida cumba
flumina servat durus senio
navita crudo vix assiduo
bracchia conto lassata refert,
fessus turbam vectare novam.

(Ed. PEIPER and RICHTER, Leipz. 1902, p. 208. L. HEINSIUS' reading : alta mors is superseded.)

(36) V. 110 begins a general pathetic introduction :

Occidis, Cadmi generosa proles.....

« atra mors » appears in v. 164; vv. 180-201 description of the plague

O dira nova facies leti,
gravior leto :
languor et aegro robor in vultu,
maculasque cutem sparsere leves.....

Medallic Illustrations of the History of Science.

Each number of *Isis*, to begin with this one, will contain, as far as space permits, reproductions of a few medals of scientific interest. We hope, in this way, to constitute gradually a collection of medals which will gratify at once and the same time the scientific curiosity and the artistic cravings of our readers. Each medal will be described and some brief information added with regard to both the man of science honored and the sculptor who designed the medal.

Plan of each description : *Man of science* represented. Dates and places of birth and death. Nationality. Branch of science, main achievement. Occasion of the celebration. Main biography.

Artist. Dates and place of birth and death.

Size of the medal.

Collection from which the specimen reproduced has been borrowed.

Publisher (if known).

Description of the medal (if a photograph is included it will suffice to reproduce the legend). Obverse. Reverse. (Followed by translation of the legends into English if they are written in a language not generally known).

* * *

The first series of one hundred will be devoted to modern medals, medals which were struck to commemorate men of science of the XIXth and XXth centuries. When the series is completed, we will print indexes of the scientists and artists represented.

* * *

No. 1. MICHEL EUGÈNE CHEVREUL (Angers, 1786-1889). French chemist, who is remembered chiefly because of his studies on animal fats, 1823. This medal was cast to celebrate his hundredth anniversary.

Artist : (Louis) Oscar Roty (Paris, 1846-1911), one of the greatest French medallists.

Size : 70 mm. Collection : G. S.

Publisher : Hôtel des Monnaies, Paris.

Obv. : Michel Eugène Chevreul, Membre de l'Académie des Sciences (fig. 1).

Rev. : La jeunesse française au doyen des étudiants, 31 août 1786-31 août 1886 (fig. 2).

No. 2. J. H. van 't Hoff (Rotterdam, 1852-1911). Dutch physico-chemist. The monument dedicated to him in Rotterdam (1915) bears the following inscription : « Physicam chemiae adiunxit ». The most elaborate biography of van 't Hoff is that by Ernst Cohen, in German, Leipzig 1912. (*Isis* I, 276-8.)

Artist : Pier Pander, born at Drachten, Friesland, 1864.

Size : 74 by 53 mm. Collection : G. S.

Obv. : 1852. J. H. van 't Hoff 1911 (fig. 3).

Rev. : Nothing.

No. 3. André Marie Ampère (1775-1836). French physicist. Founder of electrodynamics, 1820. See recent biography of him by Louis de Launay, Paris 1924. (*Isis* VIII, fasc. 27.)

Artist : Jules Clément Chaplain (Mortagne, Orne 1839-1909), one of the greatest French medallists.

Size : 50 mm. Collection : G. S.

Publisher : Hotel des Monnaies, Paris.

Obv. : André Marie Ampère (fig. 4).

Rev. : Nothing but the following inscription :

« Né à Lyon le 20 janvier 1775. Membre de la Légion d'honneur. Professeur de physique. Inspecteur général de l'Université. Membre de l'Institut. Mort à Marseille le 10 janvier 1836.

No. 4. Oscar Montelius (Stockholm, 1843, id. 1921). Swedish archaeologist (prehistoric archaeology). See *Isis* VI, 469.

Artist : Erik Lindberg, born in 1873, residing in Stockholm. (His father Adolph Lindberg, Stockholm 1839, id. 1917, was also a medallist.)

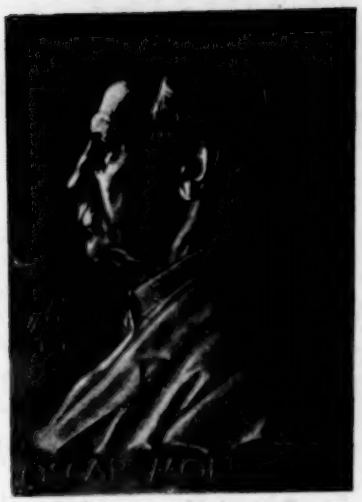
Size : 64 by 47 mm. Collection : G. S.

Obv. : Af Vänner 1913. Oscar Montelius (fig. 5).

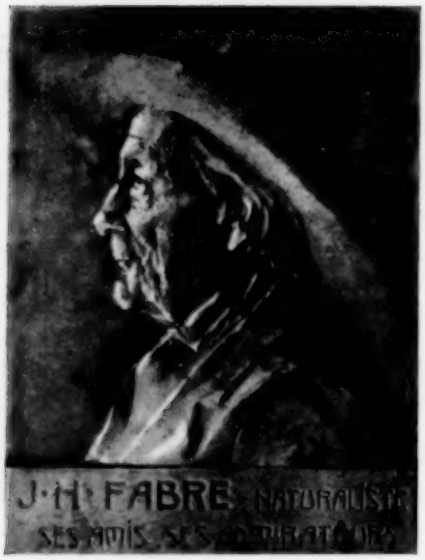
No 1, fig. 1 and 2. — CHEVREUL.

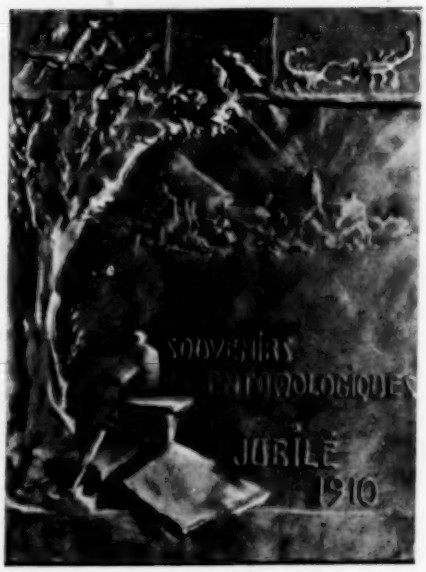
No 2, fig. 3. — VAN 'T HOFF.

No 3, fig. 4. — AMPERE.



No 4, fig. 5 and 6. — MONTELIUS.





No 5, fig. 7 and 8. — FABRE.

Rev.: Femtio års forskar-bragder eröfrade årtusenden af månsklig odling (fig. 6).

(Translation. Obv.: From his friends 1913.

Rev.: Fifty years of archaeological achievements conquering a thousand years of human civilization).

No. 5. JEAN HENRI FABRE (Saint Léons, 1823, Sérignan, 1915). French entomologist. The best biography is by G. V. LEGROS, in French, Paris, 1913. New edition 1924 (*Isis* VII, 143).

Artist: F. SICARD.

Size: 72 by 55 mm. Collection: G. S.

Publisher: The medal was first published in 1910; then again in 1913, this time by DELAGRAVE, Paris (*Isis*, I, 526).

Obv.: J. H. FABRE. Naturaliste. Ses amis, ses admirateurs (fig. 7).

Rev.: Souvenirs entomologiques. Jubilé 1910 (fig. 8).

Notes and Correspondence.

I. Queries and Answers

Edided by FREDERICK BARRY, Columbia University, New York

A. 2.—**Leonardus Qualea.** (*Isis* VI 533).—LEONARDUS QUALEA wrote his *Astronomia medicinalis* between 1470 and 1475 rather than between 1457 or 1460 and 1475, or about the year 1460, as suggested by P. DUHEM, « Ce que l'on disait des Indes occidentales avant CHRISTOPHE COLOMB », *Revue générale des sciences pures et appliquées*, XIX (1908), 402-406, — only pp. 404-6 deal with LEONARD; and *Etudes sur Léonard de Vinci*, II (1909), 325-327, repeated in *Isis*, Queries and Answers, VI (1924), 533-4. DUHEM appears to have favoured the year 1460 for the composition of the work because he unconsciously wished to push it back as far before COLUMBUS's voyages as possible. As a matter of fact, in the manuscript at the Bibliothèque Nationale, Paris (Latin MS. 10264, fol. 570), the work is dedicated to master HENRY LONGARD of Palermo, who is called in the preface a Dominican and professor of sacred theology, and archbishop of Acheruntia and Materanen. DUHEM noted this fact, but did not take the trouble to look up the years of this HENRY's episcopate, which were from 1470 to 1482. Therefore the work in question was dedicated to him in 1470 or later and not composed in 1460. LEONARD appears to have composed it in his later years, since he describes it in the aforesaid dedication as compiled from « many volumes of the Syrians, Indians, Arabs, Persians, Egyptians, Greeks and Latins which in the prime of life, while I traversed the whole world, I saw, perused, and often heard in many cases from masters ». (« Compendiolum hoc quod astronomia medicinalis nuncupari videtur ex multis Syrorum Indorum Arabum Persarum Egiptiorum Grecorum atque Latinorum voluminibus que in florenti etate dum orbem totum lustrassem vidi perlegi pleraque sepius a magistris audivi. »)

At the time I briefly examined this manuscript I did not have Dr. SARTON's query in *Isis* in mind, and had not yet seen DUHEM's periodical article. Consequently I did not verify the latter's asser-

tion that all the other treatises comprised in the manuscript, as well as LEONARD's work, were copied between 1475 and 1492 by ARNOLD of Brussels, although in the case of our particular treatise I did observe the note, « 22 octobris 1475 per A. de bruxella », at the bottom of fol. 95r. But this note does not occur immediately at the close of the text, but only after an intervening figure to illustrate the aspects of the planets. It might be, therefore, that ARNOLD of Brussels merely drew the figures to illustrate the text, although very likely he copied both.

As DUHEM treated of only two chapters of LEONARD's work, the third and fourth, it may be well to note briefly the themes of the others. Chapter one inquires what the men of old meant by the first cause. The second chapter asks what they thought concerning the world soul and the human soul. Chapter three investigates *yle*, chaos, the elements, their motion and that of the ether, by what cause the earth was uncovered by water, whence earthquakes proceed, islands and mountains rise anew and old ones are submerged, — these last three points are the portions of this chapter treated by DUHEM (1909), 325-7 — why fountains burst forth anew and old ones dry up. Chapter five deals with the material sphere, its center, the axis of the sphere, the poles of the universe, the circles of the sphere, the line of the ecliptic, the eclipse of the luminaries, and with the milky way. Chapter six is about the two luminaries and five erratic stars and their motion under the zodiac. Chapter seven considers the signs and their *triplicitates*. Chapter eight treats of the natures of the planets, and chapter nine of the planets in the signs and their rule over days and hours. Chapter ten examines why the ancients joined astronomy (*i. e.* astrology) to medicine and concludes that it was in consequence of prolonged experiments; also who the first medical authors were. Chapter eleven considers the general question of the subjection of inferior bodies to superiors and the universal influence of superior bodies on inferior bodies. Chapters twelve to fourteen take up the particular influence of the sky on the bodies of men, the special influences of the planets on the human body and the infirmities appropriate to each planet, and the relation of the twelve houses to the parts of the human body. Chapter fifteen is about the being (*esse*) and aspects of the planets and their conjunctions with one another. Chapter sixteen tells how to find out the strength and weakness of the houses and planets and which of them gains the ascendancy in the horoscope. Chapter seventeen directs how to draw up a horoscope. Chapter eighteen discusses whether it is right to investigate contingent events by the art of astrology (*per artem astronomiæ*), and the method of

formulating the question, and the form and rule to be observed in judgments. Chapter nineteen tells how to learn what ails a man from observation of the hour when his ailment began, and how to judge of its outcome from the same hour or the hour of the interrogation. Chapter twenty treats of the causes of crises and the terms of days to be observed in the making of prognostications by medical men regarding patients. The succeeding four chapters deal with election of the time of day and the laudable hour in every act in general, in each particular medical operation whether in physic or in surgery, for the cure of each member of the human body and for blood-letting and the administration of drugs respectively. Chapter twenty-five discusses the defects of the moon and its unlucky places of which one should beware in beginning any action. The next two chapters are concerned with the significance of lunar and solar eclipses, and the twenty-eighth and last chapter is about the revolution of the year and the significance of a conjunction of the heavy planets.

From this synopsis it becomes evident that the bits concerning geography and geology which DUHEM extracted from LEONARD'S work form but a very small and incidental part of it compared to the astrological medicine which constitutes its main body, but the admixture is the usual one then of science and occult science varying in ratio with the subject of a work. I was amused at the deft and rapid, not to say cavalier, fashion in which LEONARD disposed of the verse of the Bible which was often quoted against astrology : « It is not for you to know the times or the seasons, which the Father hath put in his own power : » (*Acts*, I, 7). His interpretation is that this does not forbid us to know all future times or moments, but only such of them as the Father has placed in His own power. « Therefore we are free to inquire concerning those which He put in the power of the planets (MS. BN. 10264, fol. 80v). » Surely this is separating the domains of religion and of science — or occult science — with the same clean-cut incisiveness that ALEXANDER severed the Gordian knot.

Columbia University. LYNN THORNDIKE.

A. 3. — **Giovanni de' Fontana, fl. c. 1420** (*Isis* VII, 105). — Vous trouverez les détails demandés dans une publication de CHR. HUELSEN parue dans la « Festsgabe für HUGO BLÜMNER », Zürich, Buchdruckerei Berichthaus, 1914, p. 507-15. Analyse : *Geschichtsblätter für Technik*, 1915, p. 265.

(*Munich*) COMTE KLINCKOWSTROEM.

Q. 4. — **Miles Blomefield, English alchemist** (1525-74?). — I wish to complete my list of books bearing the name of MILES BLOMEFIELD. I already know of the following which bear his name :

1. « Information for Pilgrims into the Holy Land. » Printed by WYNKYN DE WORDE, 1524. 2. « BLOMEFIELD's Quintessence or Regiment of Life. » 3. « The Conversion of S. Paul. » 4. « Mary Magdalena. » 5. « FULGENS and LUCRES. » 6. « Ortus Vocabulorum. » 7. « Promptuarium Parvulorum. »

3 and 4 are among the Digby MSS. Can any reader add to this list or furnish any particulars (other than those given by the Dictionary of National Biography) about MILES BLOMEFIELD himself ? I should be especially glad to know whether any reader possesses copies (signed MILES BLOMEFIELD or M. B.) of 6 and 7.

K. W. D.

II. The History of Science : Teaching and Personalia

Edited by HARRY ELMER BARNES (Smith College, Northampton, Mass.).

1. The present State of Instruction in the History of Science in France

La Sorbonne, Paris, France, 29 Mai, 1925.

Dear friend and colleague :

Alas ! instruction in the history of science in France is extremely precarious at the present time. Since the death of PIERRE BOUTROUX, for whom the former chair of AUGUSTE COMTE at the College of France was reëstablished, this chair has been discontinued. Outside of that, there is at the University of Lyon a chair of the History of Philosophy and of Science, — and at the University of Paris the course which I conduct under this title : « History of Philosophy in its Relations with the Sciences. » *That is all.* And you will note that these two chairs are not exclusively devoted to the history of the sciences. That at Lyon, which my colleage M. EDMOND GOBLOT ably fills, imposes upon him the very heavy task of teaching the history of philosophy in addition to that of science. Also the scope of the instruction of M. GOBLOT involves essentially the philosophy, logic and methodology of the sciences. Even my course at Paris has an implied tendency toward the subject of the history of philosophy (history of philosophy in its relations with the sciences) — but since the history of philosophy is very highly regarded at the University of Paris (MM. ROBIN, BRÉHIER, LÉVY-BRUHL and GILSON — four chairs) my course can be exclusively devoted to the history of scientific conceptions — that is — to the philosophic history of the sciences. This is really the central or main point of view of the history of science, — and the one

that leads to the general history of civilization and of humanity, which constitutes the educative discipline of the history of science.

But in the years that followed the war it was often necessary for me to turn my attention away from this definite subject to collaborate in the teaching of general philosophy and to the preparation of a series of general lectures.

I plan, now that there has been instituted at the University of Paris a « Certificate of Higher Studies » in the Philosophic History of the Sciences, to devote myself exclusively to the subject-matter which the very title of that course and certificate implies and conveys.

ABEL REY.

II. The Teaching of the History of Science in Poland

University of Poznan, Poznan, Poland, July 25, 1925.

My dear Professor :

Now, as to the teaching of the History of science in Polish universities, most of it is done in connection with the history of philosophy and depends on the individual interests of the professors. There are, however, two special chairs for this subject : one in Cracow (the history of mathematical and physical sciences) occupied by Professor LUDWIK BIRKENMAJER, and one in Poznan (the history of medicine) by Professor ADAM WRZOSEK. Besides this, the professors of a given specialty sometimes give historical courses in their field; thus, at the request of our Faculty of Law and Economics I give every year an extra course in their department (3 hours) in the history of sociology; another professor gives a similar course in the history of political theory, and a third, a more extensive course in the history of economics. It would be difficult, however, to make anything like a list of these courses; for our university system, without being as free as the German, nevertheless leaves much more freedom to professors and students than the American or French systems, and the number and range of these courses may vary from year to year.

The scientific and practical interest in the history and theory of science is very strong. There is a special department in the Ministry of Education for the promotion of science in Poland; they are publishing a year-book which, though containing much of purely local interest, gives many studies of a more general character, and much material concerning the present and past organization of scientific research; and there is a tendency to increase this theoretical and historical part. Every volume has a short résumé in

French added to it. Besides this, there are, of course, a number of works published in the history of science.

FLORIAN ZNANIECKI.

III. **Professor William A. Locy,** Ph. D., Sc. D. — In the death on October 9, 1924, of Dr. LOCY, who since 1896 had been professor of zoölogy at Northwestern University, the study of the history of science lost one of its chief exponents and advocates in America, while thousands of students and associates lost a friend whose geniality will never be forgotten.

WILLIAM ALBERT LOCY was born at Troy, Michigan, September 14, 1857. He graduated at the age of twenty-three at the University of Michigan, and immediately entered upon a course of advanced study in biology. After receiving the degree M. Sc. at Ann Arbor, he accepted a fellowship in biology at Harvard (1884-85). He was a member of the faculty of Lake Forest University as professor of biology, 1887-89, and as professor of animal morphology, 1889-96. He also spent a few months at Berlin in 1891 in the study of physiology, and held an honorary fellowship at the University of Chicago (1894-95) where he gained the degree Ph. D. in 1895. The University of Michigan recognized the importance of his contributions to the advance of knowledge by conferring upon him the Sc. D. degree in 1906.

Only cursory mention will here be made of LOCY's various achievements in the field of biological research, his initial investigations (Agelena naevia) in Dr. MARK's laboratory at Cambridge, his studies under DU BOIS-REYMOND at Berlin, his well known contributions on the embryonic development of the fore and mid-brain of fishes, his dissertation on « The structure and development of the vertebrate head », accepted by Professor C. O. WHITMAN as a thesis for the degree of doctor of philosophy, and his prolonged and careful endeavors to trace the developmental history of the eye and other sense-organs of birds and mammals. Professor LOCY, while administering at Northwestern a large department and maintaining his popularity as a lecturer, was able to impart to the advanced students in his laboratory the ideals and enthusiasm necessary for successful research.

For the last twenty-five years of his life Dr. LOCY became more and more interested in the history of science. A series of sketches and appreciations of MALPIGHI, VON BAER, and others, which appeared as magazine articles, were followed by the well known book « Biology and Its Makers », 1908. This excellent work was soon translated into German, and it took its final form in a third,

revised, edition in 1915. Besides stimulating an interest in the genesis of the theories of natural science among students of biology, Dr. LOCY's volume proved an inspiration to his colleagues in Northwestern University and to instructors in other institutions of higher learning, and thus promoted the study of the history of science in general. In 1918 there appeared LOCY's second book, « The Main Currents of Zoölogy », a succinct and well proportioned account of the progress of the science in modern times. On the fly-leaf of the copy before me is a freehand drawing of a bush in fruit. The root is supposed to represent the discovery of protoplasm, and successive clusters stand for the germ theory, bacteriology, organic evolution, the cell-theory, and genetics. Underneath are the words, written by the author with characteristic playfulness : « Here, my dear —, we have the Main Currants, the fruit of more nurture than the size of the container would indicate. » It is gratifying to learn that Professor LOCY's third volume, « The Rise of Biology », is now in press (HENRY HOLT & Company).

LOCY's intimate interest in the personal character and lives of the great biologists, mentioned in his three volumes as well as in the historical contributions which he continued to make from time to time to periodical literature, is characteristic. He was remarkably kindly and sociable. There was about him nothing of the academic automaton. The hours spent with his friends in recreation pure and simple, in conversation grave and gay, he did not count wasted. In all the domestic relationships, as in social relationships in general, he was alike admirable, — prudent in counsel, open-minded, tolerant, sympathetic, always guided in word and deed by manly sentiments and noble principles. Therefore, a host of friends feel, even as the members of his own family, a sense of his abiding influence if not of his actual presence; *mihi, quamquam est subito ereptus, vivit tamen semperque vivet.*

(*Toronto.*) WALTER LIBBY.

Reviews

Walter Scott. — ***Hermetica***, **The ancient Greek and Latin writings which contain religious or philosophic teachings ascribed to HERMES TRISMEGISTUS. Edited with English translation and notes. Vol. I. Introduction. Texts and translation 549 p. Vol. II. Notes on the Corpus Hermeticum 482 p. Oxford, Clarendon Press, 1924-5.**

The appearance of the first two volumes of SCOTT's *magnum opus* on *Hermetica* is very welcome. It is pleasant to be able to read these writings with so much ease and with a sense of greater security. Before examining them it is well to make two preliminary remarks. In the first place, this is only the first half of SCOTT's work. Two more volumes are in the course of preparation of which the one (III) will contain the rest of the commentary and the other (IV), the testimonia, appendices and indexes. In the second place, there are two kinds of Hermetic writings, the religious and philosophic writings dealt with in the present work, and writings concerning astrology, magic, alchemy and kindred forms of pseudo-science. SCOTT has every right to ignore the second kind, which are so different from the first that they need separate treatment, but one is painfully surprised to hear a great scholar call them « masses of rubbish ». Rubbish ! That rubbish is very precious to our heart, for it may be hoped that their study will eventually help us better to understand the development of Alexandrian alchemy and astrology. They are not more to be despised than the very writings to which SCOTT had devoted so much ingenuity and love. Might not a student of PLATO and PLOTINUS, who did not care for archaeology, call these also, rubbish ? Rubbish ! Not more than the masses of papyrus fragments discovered in Egypt or the dirty scraps of paper which have been brought back from Central Asia. It would have been wiser to leave that word out. However interesting SCOTT's study, the investigation of that Hermetic rubbish will be more interesting still.

To come back to the work in hand. It contains little or nothing of immediate concern to the historian of science, but it is valuable as it throws more light on the intellectual life of the IIIrd century in Egypt, a period of extraordinary syncretism. We cannot well understand the scientific development of that period if we do not

fathom its philosophic atmosphere. Practically all of the Hermetic writings edited by the author were composed in Roman Egypt within the third century. (Only one can be dated with greater precision : the Greek original of Asclepius Lat. III was probably written c. 270.) It is even plausible to assume that they reflect the teaching of AMMONIUS SACCAS (d. c. 243), the inspired master of PLOTINUS. They were traditionally ascribed to the great god Thoth (Hermes Trismegistus) in order to increase their prestige. They are deeply religious and their essential message could be well expressed by the sentence : « Blessed are the pure in heart, for they shall see God. » But they differ from other religious writings of the same time in two essential respects : they recognize no inspired and infallible Scripture, hence a directness and simplicity of statement such as is not being found in Jewish or Christian works; they do not contain any *theurgia*, that is, ritualism or sacramentalism. They are mainly derived from the Platonic writings, and in the first place of course from the *Timaeus*, but they show also many traces of Stoicism. This alone makes it impossible to ascribe to them a greater antiquity (as FLINDERS PETRIE tried to do it); they must needs be posterior to the time when the teachings of the Academy and of the Stoa were sufficiently blended and when it had become more usual for Platonists to Stoicize and Stoics to Platonize. This new departure may be dated, roughly speaking, at about 100 B. C. The most prominent of the Platonizing Stoics was POSIDONIUS who flourished in the first half of the Ist century B. C. and his influence can be detected in some of the Hermetica. But in fact these writings are, as I said above, much younger still, since they belong, in their present form at least, to the IIIrd century of our era.

The Hermetica contain surprizingly few Egyptian ingredients, but they reveal a greater intensity of religious fervour than can be found in any of their Greek sources, or in any Greek philosophical writing down to PLOTINUS, himself an Egyptian by birth and bringing up. It is this religious tone which is the distinctively Egyptian element in the Hermetica. « What we have in them is the effect that was produced by Greek philosophy when it was adopted by men of Egyptian temperament. » The Jewish borrowings are also exceedingly small and there is hardly any trace of Christian origin. Hindu influences might be assumed *a priori*, but the author does not even refer to them; thus if the Hermetists were at all subject to such influences, at any rate they did not reveal it in their compositions.

The extant Hermetica can be divided in four groups (I indicate for each group the number of pages which they occupy in SCOTT's edition, in order to give the reader some idea of their respective masses): (1) the XVIII Libelli of the Corpus Hermeticum (86 p.); (2) the Latin Asclepius mistakenly attributed to APULEIUS (46 p.); (3) the Hermetic excerpts in the Anthologium of STOBAEUS, end of Vth century (77 p.); (4) the fragments quoted by LACTANTIUS, CYRIL, etc. (8 p.).

The main part is the so-called *Corpus Hermeticum*, a collection of documents (from 17 to 20 in number according to one's reckoning), which first makes its appearance (as a collection) in MSS. of the XIXth century. The earliest edition of that Corpus was the Latin translation published by MARSIGLIO FICINO in 1471, and which was so successful that 8 editions of it appeared before 1500 and 22 before 1641. The Greek princeps was edited by TURNEBUS at Paris in 1544.

The history of the formation and transmission of that Corpus, as much as it can be reconstructed, is unusually interesting. I will try to explain it briefly. While the reputation of Hermes dwindled in Egypt and Europe, it maintained itself in Harran, in northern Mesopotamia. The Harranians were belated Pagans, who had resisted the Christian tide and later the Muslim tide, but in the time of AL-MA'MÛM they found it expedient to call themselves Sabians, for that is the name of a religion of which God speaks in the Qur'ân. To be entitled to Muslim toleration it was necessary also that they should have a Book (religious scriptures) and they chose the Hermetica. (By the way, this would prove that a collection of Hermetica was known and read in Syria c. 830; the Harranians were probably acquainted with them both in the original Greek and in Syriac translation.) The most famous of these Harranians (or Sabians) was THABIT IBN QURRA (835-901), who caused a schism in the community and was forced c. 872 to emigrate to Bagdad. The Harranian Neoplatonists of Bagdad were still holding to the Hermetica as their Scripture and they were able to do so as long as Muslim toleration lasted. But the Ash'arîtes, the « Fundamentalists » of Islâm got gradually the upper hand and by the middle of the XIth century Bagdad must have become a very uncomfortable place for the remaining Sabians. Now it had been assumed on other grounds that the Corpus Hermeticum was established in Constantinople at that very time by MICHAEL PSELLUS, who was the leader of the Byzantine Neoplatonic revival. It is quite plausible that PSELLUS received it from one of the Sabian refugees. In brief the Hermetica travelled in the Neoplatonic

vehicle from Alexandria (IIIrd cent.) to Harran (VIth cent.), hence to Bagdad (IXth cent.), hence to Constantinople (XIth cent.), hence to Florence (XVth cent.).

Their contents do not concern the historian of science, but the account of their journey is extremely instructive for the road which they followed was one of the main roads in the history of civilization and many things must have travelled along it together with the *Hermetica*.

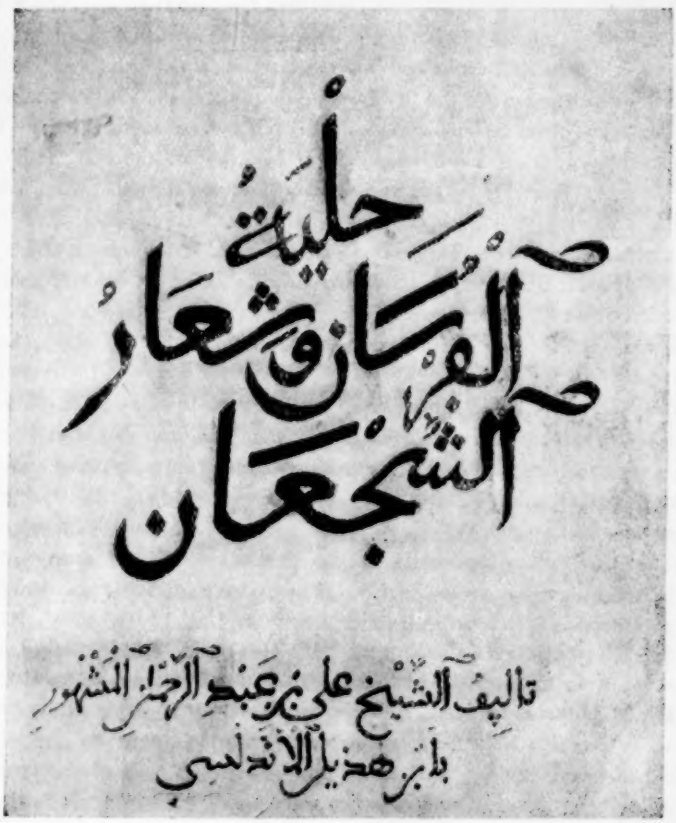
GEORGE SARTON.

[**Ibn Hudhail, ʿAlî ibn ʿAbd al-Raḥmân al-Andalusî**, fl. c. 1356] *La parure des cavaliers et l'insigne des preux*. Edité d'après le MS. de M. NEHLIL, revu et corrigé sur l'exemplaire de la bibliothèque de l'Escurial, par LOUIS MERCIER, Consul de France. IV+98 p., 1922 — Traduction française précédée d'une étude sur les sources des hippiatres arabes et accompagnée d'appendices critiques sur l'histoire du pur-sang, de l'équitation et des sports hippiques arabes, en Maghreb et en Orient. Avec 23 photographies et 11 dessins. Par LOUIS MERCIER. XVI+583 p., 1924. Paris, PAUL GEUTHNER, 1922-24.

This most interesting publication is at first, a little confusing. I will try to explain the matter briefly, and a little more clearly than the author. IBN HUDHAIL flourished at Granada under the reign of MUHAMMAD V (king from 1350 to 1362) who ordered him to write a treatise on jihâd. There is a good MS. of that treatise in the Escorial (no. 1652). The treatise contains two parts of which the first deals with the military art and the second, with hippiatry. Now, some time later, under the rule of MUḤAMMAD VI, King of Granada from 1392 to c. 1408, a second treatise was composed which was largely an abbreviated copy of the second part of the first one. We might thus say, tentatively, that the first treatise was composed c. 1356 and the second c. 1400. This second treatise is anonymous. It is entitled : Ḥilyat al-fursân wa shiʿâr al-shujʿân, of which the French title chosen by Mr. L. MERCIER is a good equivalent. The editor suggests that it was perhaps a second edition prepared by the original author, but he does not adduce a single argument in favor of his hypothesis. This does not seem plausible, because some forty-four years elapsed between the two editions, and because the original author would in all likelihood have attached his name to the second edition (as he did to the first) and explained its peculiarities. It is more plausible to assume that the Ḥilyat al-fursân is a plagiarism.

It seems that the editor got hold of the second, abbreviated, treatise, first; later he became acquainted with the larger treatise

through Mr. NEHLIL, Director of the Ecole supérieure de langues et littératures arabes of Rabat. Mr. NEHLIL, intrusted to him a MS. of that treatise, MS. which seems inferior to the Escorial MS. (I say « seems », because the editor gives practically no information on the age, provenance and value of these MSS.). Now, the edition given to us is a photographic reproduction of the second half of the inferior MS. of the first treatise, with the title page of the second



treatise, the whole followed by errata obtained by collation with the Escorial MS. Is this not a tortuous procedure ? Why not photograph the best MS., and above all, why publish an edition of one work with the title of another ? This is bound to be a cause of confusion. — I must admit that the MS. reproduced is very beautifully written.

To speak now of the second volume, the French translation, which will be used by a far greater number of scholars, it is a very valu-

able contribution to our knowledge of Muslim civilization. I would hardly say science, for this treatise on hippiatry contains very little of special interest to the naturalist and the veterinarian. It is worth while to reproduce the original table of contents to give the reader some idea of a Muslim textbook on that subject :

« 1. Sur la création du cheval, sur qui l'a domestiqué le premier, sur sa diffusion dans le monde; 2. Sur les vertus mystérieuses des chevaux et ce qui est promis à qui en élève; 3. Sur l'entretien des chevaux, les soins à leur donner, les recommandations faites à ce sujet; 4. Sur les noms que les Arabes donnent aux différentes parties du corps du cheval et le nombre de ces vocables qui sont noms d'oiseaux; 5. Sur les qualités à rechercher dans les différentes parties du corps et les ressemblances qu'il est bon que le cheval présente avec certains animaux ; 6. Sur les robes, signes, pelotes, balzanes et épis; 7. Sur ce qu'il faut rechercher chez les chevaux : caractéristiques des plus nobles d'entre eux; noms par lesquels on désigne les chevaux de race et de sang; 8. Sur les vices naturels et acquis; 9. De l'épreuve des chevaux, de leur choix, physiognomonie du cheval; 10. De l'apprentissage de l'équitation en ses diverses manifestations; 11. Des courses de chevaux, du peloton à l'arrivée, des paris; 12. Noms des chevaux du Prophète béni et de quelques-uns des plus réputés parmi les Arabes ; 13. Termes et noms de choses spéciaux aux chevaux; 14. Citations des poètes sur la préférence marquée par les Arabes pour les chevaux plus que par aucune autre race, les soins qu'ils leurs donnaient, la gloire qu'ils en tiraient ; 15. Du sabre; 16. De la lance; 17. Des arcs et des flèches; 18. Des cuirasses (cottes de mailles, etc.); 19. Des boucliers et armes analogues; 20. Des armes et équipements en général. »

The editor has apparently made a deep study of many other Arabic treatises of the same kind, from the earliest ones down to very modern ones — notably the Nukhbat ʿiqd al-ajyâd fî-l-ṣâfinât al-jiyâd (Stambul 1907) composed by the amîr MUḤAMMAD PASHA, MUḤYI AL-DÎN, a son of ʿABD AL-QÂDIR (who surrendered to the French in Algeria, in 1847). This enables him to add much information of Muslim origin in the footnotes and appendixes, and thus to give the reader some knowledge of the hippiatric literature available in Arabic. The first appendix (p. 283-306) deals with the training of horses; the second (p. 307-351) is a study on the origin and varieties of the Arabian horse — a hopelessly difficult question — and deals incidentally with the customs relative to the sale of horses (interesting facsimile of a ḥujjat or pedigree). Appendix III (p. 353-61) is of greater biological interest being devoted to the Muslim views on the proper conditions for leaping and on the different ages of horses, the names given to them at various periods of their life and the means of telling their age. Appendix IV (p. 363-71), deals with the care of horses, their diet and training.

Much of all this is translated from the work of MUḤAMMAD PASHA previously quoted. — Appendix V is a reprint of an account of an equestrial evolution witnessed at Mogador in 1818 by the sea captain JAMES RILLEY. The sixth and last appendix is probably the most interesting, being a historical sketch of Muslim hippiatry throughout the ages. This is followed by an abundant bibliography, which forms a very valuable supplement to the enormous hippiatric bibliography recently published by General MENNESSIER DE LA LANCE (see *Isis*, VIII,): it is not restricted to European publications but contains as well a long list of Arabic works (p. 431-59). However, it is much to be regretted that the author did not give us a catalogue raisonné of that important branch of Arabic literature, nor provide a chronological summary. Finally, there is a long Arabic index. The work contains a good number of illustrations, reproductions of various pictures found in MSS. and of photographs of horses.

Mr. MERCIER's studies are of special interest to students of the Arabic language and of Muslim culture. To show their cultural importance it will suffice to recall that the horse is almost a sacred animal in Islam. The Prophet clearly expressed the divine will with regard to this. Mr. MERCIER gives a curious illustration of this which I better quote using his own words :

« C'est sans doute, du même sentiment religieux et supertitieux que procède la coutume marocaine d'accorder au cheval le droit d'asile, tout comme à une mosquée, un sanctuaire quelconque, un canon. L'homme poursuivi ou déjà arrêté s'accroche des deux bras, s'il le peut, aux antérieurs du cheval d'un Caïd, d'un chef, petit ou grand et, de ce fait, il devient « emzâweg fil'âud » réfugié auprès du cheval et le propriétaire de celui-ci est, dès lors, tenu d'employer toute son influence en faveur de ce protégé indirect.

» Le Père BUSNOT croit que ce droit d'asile n'était accordé qu'à ceux des chevaux de MYE ISMAËL que ce Sultan avait emmenés en pélerinage à la Mecque et qui restaient considérés comme sacrés. Il est possible, en effet, que le droit de « rusg » ait commencé par être le privilège exclusif d'une catégorie de chevaux, mais il faut constater qu'il s'est étendu depuis, non seulement à tous les chevaux détenus par des musulmans, mais même à ceux des chrétiens et je pourrais citer plus d'un cas où un officier ou un fonctionnaire français l'a vu appliquer à son propre cheval. »

Historians of science must know of these studies, though they will find in them relatively little grist for their own mill. As it is, the work pleased me greatly and would have pleased me even more if I had happened to be a better judge of horseflesh.

GEORGE SARTON.

Joannes de Ketham? — ***The Fasciculo di Medicina.*** Venice, 1493. With an introduction, etc. by CHARLES SINGER. 2 vol. folio. Part I, 112 pp., atlas of 90 illustrative figures from manuscript and printed sources with explanatory legends; Part II. Facsimile 104 pp. (***Monumenta Medica*** under the general editorship of HENRY E. SIGERIST, volume II.) Florence, R. LIER, 1925. ($ 14)

I have spoken at some length in *Isis*, VI, 547-49, of the first volume of SIGERIST's *Monumenta Medica*, which was devoted to a facsimile of the editio princeps of the Fasciculus Medicinae, Venice 1491, with a commentary by KARL SUDHOFF. I then explained the general purpose of the collection. The second volume, devoted to the second edition (that is, the first Italian edition), Venice 1493, Febr. 5 (N. S. 1494), is at least as interesting as the first volume. For one thing, this second edition of the Fasciculus is a very handsome volume; the woodcuts illustrating it are very fine indeed; the font of type, imitating the humanistic hand-writing of the period, is very pleasing to the eye. In the second place, SINGER's introduction is very complete and very lucid, and it includes an English translation of MONDINO's Anathomia. It will be remembered that this text was not a part of the editio princeps of 1491; but that an Italian version of it forms an integral part — in fact, the last third — of the edition of 1493.

SINGER's introduction, bountifully illustrated, is divided as follows : 1. *Description of the Fasciculo.* That is, description, discussion, and commentary of each illustration and each treatise included in the Fasciculo (pp. 9-35). — 2. *Editions, art and language of the Fasciculus medicinae.* SINGER describes thirteen editions, to wit : six Latin editions, Venice 1491, 1495, 1500, 1500 (N. S. 1501), 1513, 1522; four Italian editions : Venice 1493 (N. S. 1494), 1508; Milan 1509; Venice 1522 (N. S. 1523); three Spanish editions : Burgos 1495; Pampelona 1495; Seville 1517. These editions range from 1491 to 1522 (N. S. 1523). — 3. *Anatomy of* MUNDINUS. This contains, as aforesaid, a complete English translation of the Anathomia, with an introduction explaining its historical significance, its sources, its editions and MSS., various notes, and a glossary (pp. 45-112). — The atlas of 90 illustrations following SINGER's text forms an iconographic history of medieval anatomy, which will be extremely valuable for teaching purposes.

The second part contains the facsimile of the Fasciculo and gives one the illusion of owning a copy of the original ! The publishers, the general editor, and the author have equal claims to our gratitude.

GEORGE SARTON.

Karl Sudhoff. — ***The earliest printed Literature on Syphilis, being ten tractates from the years 1495-1498.*** **In Complete Facsimile with an Introduction and other Accessory Material, adapted by** Charles Singer. (***Monumenta Medica***, **edited by** Henry E. Sigerist, **3), Florence, R. Lier, 1925.** [$ 10]

Karl Sudhoff gave us, fourteen years ago, two valuable books on early syphilis literature : Aus der Frühgeschichte der Syphilis. Leipzig 1912; and Graphische und typographische Erstlinge der Syphilis-literatur aus den Jahren 1495 und 1496, Munich 1912 (*Isis*, I, 272). The latter contained facsimile reproductions of eight documents relative to the earliest history of syphilis from the cultural point of view — the earliest printed mentions of the dreadful disease. The present volume places « before the reader, in facsimile form, the professional literature of the fifteenth century which deals with Syphilis in a formal fashion. »

« The early literature of the *Lues venerea* falls quite naturally into three divisions : *a*) The ten first treatises on the disease printed in Germany and Italy. Most of these were issued more than once from the press during the years 1495-98. A copy of the first edition is in each case reproduced complete in this volume with portions from later editions or versions. *b*) The literature associated with a controversy as to the nature and origin of Syphilis carried on at Leipzig in the years that followed 1498 and associated especially with the names of Simon Pistor and Martin Pollich of Mellerstadt. *c*) A loosely connected series beginning with the verses appended to the *Sumario dela Medicina* of Francisco Lopez de Villalobos (1473-1560?), continuing through the *Remede tresutile pour ... la grosse verolle* of Lyons 1501 which was issued as an appendix to a *Regimen sanitatis en francois* and also through Peter Pinctor, the later work of Torrella and the later work of Grünpeck, up to Alexander Seitz in 1509.

The works constituting the first and most homogeneous of these groups will here concern us. They exhibit the earliest attempt to treat the newly recognised scourge of humanity as a separate and special medical topic. »

Aside from their medical interest, these tracts illustrate the intimate connection between the contemporary life of Italy, Spain and Germany. They illustrate also how the new art of printing had already become an instrument for the advancement and diffusion of knoweledge. It should be noted that these tracts were among the earliest printed medical books produced by contemporary authors. Indeed, the earliest medical books to be printed — in 1471 and 1472 — were the works of medieval writers : « Mesue »; the Salernitan *Antidotarium* ascribed to Nicolaus; the *Conciliator* of Peter of Abano; *the Regimen Sanitatis* of Taddeo of Florence.

It is true, the same year 1472 saw the publication of two « original » works of living authors : the *Practica* of FERRARI DA GRADO (for which, see *Isis*, VII, 198) and the *De Aegritudinibus puerorum* of PAOLO BAGELLARDI — but the originality of these works was slight. For other medical literature contributed by contemporary physicians we have to turn to more popular publications — the bloodletting calendars (hundreds of which appeared), and the regimens. Two early tracts on the plague were also contemporary productions, to wit, the earliest of all, HEINRICH STEINHEIL's *Regimen wider die Pestilenz* (Ulm 1473) and MARSIGLIO FICINO's *Consiglio contra la pestilenzia* (Florence 1481). But these were exceptions : the great mass of incunabula plague tracts were fourtheenth-century productions. More generally the overwhelming mass of medical incunabula was still medieval and scholastic.

The earliest tracts on syphilis here reproduced and briefly discussed marked a new, if humble, departure. The subject was one which touched deeply the curiosity and the feelings of the reading public; it was one which lent itself at once to new observations and to long discussions, thus giving scope to the scholastic habits of most educated people, yet at the same time allowing a modicum of development to the experimental method, which had never been entirely lost. These ten tracts appeared within a little more than two years, from early in 1496 to March 1498, and were produced by men of four nationalities, Germans and Italians, one Spaniard and one Austrian. I give below their titles, together with a brief characterization of each work :

1). KONRAD SCHELLIG of Heidelberg *In* (i. e. Contra) *pustulas malas morbum quem malum de francia vulgus appellat que sunt de genere formicarum salubre consilium*, Heidelberg, 1495-96. SCHELLIG's personal acquaintance with the disease was obviously very slight; yet he had some knowledge of its eruption.

2 and 3). JOSEPH GRÜNPECK of Burckhausen. *Tractatus de pestilentiali scorra sive mala de franzos*, Augsburg, November 1496. *Ein hübscher Tractat von dem Ursprung des Bösen Franzos*, Augsburg, December 1496. GRÜNPECK had some knowledge of the treatment by mercurial inunction and of the inflammation of the mouth following it; he explained that this inflammation could be kept within limits by means of mouth-washes. He gave the astrological theory of syphilis, supposed to have been initiated by a conjunction of Saturn and Jupiter. According to astrologers, the plague really began in 1484, a Scorpion year. GRÜNPECK's book was the most popular of the treatises here reproduced, seven editions of it appearing within three years in four German cities.

4). NICCOLÒ LEONICENO of Vicenza. *Libellus de Epidemia, quam vulgo morbum Gallicum vocant,* Venice, June 1497. This treatise contains an account of the disease and its treatment (the abuse of mercurial inunction being deprecated), but it is largely made up of academic statements and criticisms of Muslim medicine, chiefly of AVICENNA. LEONICENO held that syphilis was a very ancient disease, already mentioned by HIPPOCRATES.

5). CASPARE TORRELLA of Valencia. *Tractatus cum consiliis contra pudendagram seu morbum gallicum.* Rome, 22 November 1497. TORRELLA was body physician to the Pope ALEXANDER VI (RODERIGO DE BORGIA). Within two months (Sept., Oct. 1497) he had opportunity to treat seventeen cases of syphilis in the Pope's family and the papal court; he describes five typical cases. He mentions five different forms of mercurial ointment. He states that the disease originated in France in 1493. TORRELLA's work is by far the most valuable of these ten early treatises, from the scientific point of view.

6). HANS WIDMANN of Tübingen also called MEICHINGER and SALICETUS. *De pustulis et morbo qui vulgo mal de franzos appellatur,* Strassburg 1497 and Rome 1497. HANS WIDMANN of Tübingen or MEICHINGER (not to be mistaken for his namesake and contemporary, HANS WIDMANN of Eger in Bohemia, the mathematician) had much experience of leprosy and took special pains to distinguish syphilis from leprosy. According to him, the essential symptoms of syphilis are the rashes and the affection of the mouth.

7). CORRADINO GILINO. *De morbo quem gallicum nuncupant,* Ferrara, 1497. This is a much poorer contribution. GILINO recommends that the mercurial ointments should contain a certain proportion of sublimate of mercury. He recommends also the application of a red-hot iron to the region of the coronal suture !

8. BARTHOLOMAEUS STEBER of Vienna. *A Malafranczos, morbo Gallorum, praeservatio ac cura.* Vienna, 1498. Even more medieval than the previous item. The astrological theory is repeated.

9). NATALE MONTESAURO of Verona. *De dispositionibus quas vulgares malfranzoso appellant.* Verona ? 1498. Contains the earliest description of the characteristic bone pains, experienced by the author in his own person. However, this is essentially a scholastic treatise written against LEONICENO in defence of AVICENNA.

10). ANTONIO SCANAROLI of Modena. *Disputatio de morbon gallico.* Bologna, 26 March 1498. Worthless publication from the scientific point of view, it is of some historical interest because it was written against AVICENNA and MONTESAURO in defence of LEONICENO. SCANAROLI held that syphilis could arise in the sexual organs *de novo !*

This is a very beautiful book, which will be an ornament to any medico-historical library and will help to diffuse accurate knowledge on the early history of syphilis.

GEORGE SARTON.

Le grant Kalendrier et compost des Bergiers avecq leur Astrologie et plusieurs aultres choses. Imprimé nouvellement pour PAYOT, libraire à Paris. 110 pp. 1925. [30 fr.]

Réimpression d'après la transcription par BERTRAND GUÉGAN de l'édition troyenne de NICOLAS LE ROUGE. Les figures de l'édition originale sont reproduites en fac-simile. Il est regrettable que cette réimpression n'ait pas été précédée d'une courte note bibliographique. Ce calendrier est une vraie petite encyclopédie à l'usage des bergers. Il renferme les matières suivantes : le calendrier proprement dit avec dictons et conseils médicaux (ceux-ci en latin). « Le Kalendrier sur la main pour scavoir les festes et quels jours elles sont. » Propriétés des planètes. Comment connaître l'heure la nuit. Certains bons régimes et enseignements de bergers. Nature des douze signes. Les quatre complexions. Physiognomonie. Dits des bêtes domestiques et sauvages et des oiseaux. Honneur et état de bergerie. Vie du berger : vêtement, chien, houlette, chapeau, instruments de musique. Manière de connaître le temps par les bêtes et les oiseaux. Chanson du berger composée par MARTIAL de Paris. L'arbre des vertus et l'arbre des vices. Peines de l'enfer. Credo. Dix commandements. Patenostre et ave maria. « Dictié des trespassez. » Ames du purgatoire. Cheval de l'Apocalypse. Phlébotomie. Signes par lesquels les bergers connaissent les maladies. Division du temps et régimes selon la saison. Petit traité de cuisine. Dialogue où « les pastoureaulx parlent de la vie et estat de bergerie et l'annonce a eulx faicte par les archanges de la nativité de Nostre Seigneur. » Traite d'astrologie. Remède pour les femmes. — J'ai cru utile de donner ce résumé de l'ouvrage pour montrer combien il est compréhensif.

Cette nouvelle édition est très peu satisfaisante car elle ne nous donne aucun renseignement sur l'ouvrage original, sauf la très brève indication contenue dans le colophon : « Ci finit le grand kalendrier et compost des Bergiers, transcrit par BERTRAND GUÉGAN d'après l'édition troyenne de NICOLAS LE ROUGE... » La date de cette édition troyenne n'est même pas donnée ! — Pour combler cette lacune j'ai consulté l'excellent ouvrage de H. OSKAR SOMMER. The Kalender of Shepherdes. The edition of Paris 1503 in photographic facsimile. A faithful reprint of R. PYNSON's edition of London 1506. Edited with a critical introduction and glossary, 3 vol. Lon-

don, KEGAN PAUL, 1892. SOMMER décrit longuement plusieurs éditions françaises incunables, en commençant par celle imprimée par GUIOT (*sic*) MARCHANT, à Paris, le 18 avril 1493. Il existe au moins deux exemplaires de cette édition, l'un dans la bibliothèque de J. P. MORGAN, à New York, et l'autre à la Bibliothèque Nationale de Paris; ce dernier exemplaire sur parchemin est un des plus beaux livres qui aient jamais été produits.

Cette édition de 1493 n'est pas la première cependant. Le Catalogue des Incunables de France de MARIE PELLECHET, vol. 3, 1909, p. 9, en cite au moins deux antérieures : Paris, GUIDO MARCHANT, 1491 et 1491, 2 mai.

Plusieurs autres éditions parurent à Paris et à Genève avant le XVI^e siècle. Pour plus de détails, voir les deux ouvrages déjà cités. Quant aux éditions de NICOLAS LE ROUGE, SOMMER en cite deux datées de 1510 et 1529. L'une de celles-ci a donc probablement servi de base à la réimpression de 1925 et on est en droit de se demander pourquoi elle a été choisie. Il se peut que le choix soit dû au hasard. L'ouvrage de SOMMER contient des détails abondants sur les éditions anglaises du même ouvrage, dont la première (reproduite en fac-simile dans le vol. 2) parut à Paris en 1503. Cette édition en très mauvais anglais n'eut aucun succès en Angleterre. Une seconde édition anglaise (la première d'Angleterre et la première vraiment anglaise) fut imprimée par RYCHARD PYNSON, à Londres, en 1506; le texte de celle-ci est reproduit dans le vol. 3. SOMMER étudie ensuite les curieuses gravures sur bois, les relations entre les éditions françaises et anglaises, le contenu et les sources du calendrier et donne un glossaire anglais.

GEORGE SARTON.

Erich Adickes. — *Kant als Naturforscher*. Bd. I. XX+378 S., 1924. Bd. II. VIII+494 S., 1925 Gr. 8°. Berlin, W. DE GRUYTER & C°. [Geh. 13,50 bzw. 24 Mk.]

Dieses Werk stellt alles, was bisher in dieser Richtung geschrieben wurde, nicht nur durch seinen Umfang, sondern auch durch die Gewissenhaftigkeit der Arbeit, weit in den Schatten. Seine Anfänge reichen 20 Jahre zurück. Im Jahre 1914 begann der Verf. die Ausarbeitung. Diese führte ihn aber zu einer näheren Untersuchung des naturwissenschaftlichen Teils des sog. « Opus postumum », einer bisher noch nicht gedruckten (auch nicht druckfertigen) Handschrift KANTS mit dem Titel « Uebergang von den metaphysischen Anfangsgründen der Naturwissenschaft zur Physik » (die als letzter Band der grossen KANTausgabe nun doch noch erscheinen soll). Aus den 4 Wochen, in denen der Verf. diesen Teil der

Arbeit zu bewältigen gehofft hatte, waren 4 Jahre geworden. Als Frucht kam unterdessen eine eigene Schrift des Verf. über « KANTS Opus postumum » heraus (50. Ergänzungsheft der Kantstudien. XX+885 S., Berlin 1920). So konnte ADICKES erst jetzt das grosse Werk zur Vollendung bringen.

Das Wort « Naturforscher » im Titel soll auch die naturphilosophische Arbeit mit einschliessen. Es werden also KANTS Gesamtbestrebungen auf naturwissenschaftlichem Gebiet zusammengefasst. Zu diesem Zwecke studierte der Verf. (der zunftmässig zur Philosophie gehört) nicht nur KANT selbst, sondern auch alle bisherigen Beurteiler seiner naturwissenschaftlichen Betätigung (die wegen ihrer sorglosen Arbeit häufig genug schlecht weg kommen). Das mag selbstverständlich sein. Was aber, selbst bedeutenden Gelehrten, nicht immer selbstverständlich ist : Der Verf. beurteilte KANT als Naturforscher nicht aus der Gegenwart heraus, sondern er stellte ihn seine Zeit hinein. Das erforderte das Studium der vorangegangenen und der damaligen Problemlage in der gesamten Naturwissenschaft : Bei dem heutigen Mangel an zuverlässigen Gesamtdarstellungen ein Riesenunternehmen, das in sachlicher wie historischer Beziehung als geglückt zu bezeichnen ist.

Den Inhalt hat Verf. nicht nach der Zeitfolge, sondern nach Gegenständen geordnet, da sonst zu viel Ueberschneidungen vorkämen. Ich gebe wenigstens die Ueberschriften der einzelnen Abschnitte. Einleitung (64 S.). I. KANTS Erstlingsschrift über die wahre Schätzung der lebendigen Kräfte. II. Die dynamische Theorie der Materie. III. Die Lehre von der Bewegung. IV. Allgemeine Aethertheorie : Wärme, Feuer, Licht, Magnetismus, Elektrizität, Kohäsion und Aggregatzustände. V. Allgemeine Naturgeschichte und Theorie des Himmels oder Versuch von der Verfassung und dem mechanischen Ursprunge des ganzen Weltgebäudes, nach NEWTONischen Grundsätzen abgehandelt. VI. Naturgeschichte der Erde und physische Geographie. I. Anhang. KANTS Geschichtsphilosophie. II. Anhang. KANTS Teleologie in der Kritik der Urteilskraft. Schluss.

Die Ergebnisse seiner Untersuchung hat Verf. nicht nur in den einzelnen Abschnitten selbst, sondern nochmal eigens in dem 11 S. umfassenden Schluss klar und übersichtlich zusammengestellt. Sie sind für KANT als Naturforscher wie als Naturphilosoph ungünstig. Zum Naturforscher fehlte ihm so ziemlich alles. Er konnte keine Mathematik. Wiewohl er viele Jahre Mathematik « las », fehlte ihm sogar in der Elementarmathematik (von der höheren hatte er überhaupt keine Ahnung) jede Veranlagung, etwas selbständig zu überlegen oder gar anzugreifen. Für das Experiment hatte er gar

keine Neigung. Aber es mangelte ihm überhaupt das Bedürfnis nach Anschaulichkeit. Noch schlimmer: Die von ihm benutzten Begriffe schillerten im Laufe seiner Ueberlegungen in allen Farben. An Einfällen ist grosser Reichtum vorhanden; es fehlt aber überall die konsequente Durchführung. Er steht in allen diesen Richtungen weit hinter LEIBNIZ, EULER, d'ALEMBERT, u. a. Die NEWTONsche Verzichtleistung auf Hypothesen ist ihm fremd. Das bringt ihn auch in der Naturphilosophie auf ganz falsche Wege. Manche seiner Ansichten streifen schon an das Phantastische. Er darf hier ohne weiteres als Vorgänger SCHELLINGS betrachtet werden, und es war ein Glück, dass Naturphilosophie nicht sein Hauptgebiet wurde. Im ganzen kann man sagen, dass KANT nicht zum konkret-anschaulichen Typus gehörte, sondern vorwiegend ein deduktiver Kopf war.

Wenn man trotzdem KANT Grosstaten auf dem Gebiete der Naturwissenschaften zuchreiben darf, so liegt das daran, dass KANT ein wissenschaftliches Genie war, nicht nur mit weit ausgedehnten Interessen, sondern auch mit ausgebreiteten, durch beständige Lektüre systematisch erweiterten Kenntnissen. Zwar kann er nicht ernsthaft als Vorläufer der Deszendenztheorie betrachtet werden, und er hat auch nicht die mechanische Wärmetheorie begründet. Aber er ist der Schöpfer der in der Kosmogonie noch heute nicht völlig abgetanen Nebularhypothese, die er (im Gegensatz zu LAPLACE) bis ins einzelnste ausarbeitete. Er erkannte als erster den Einfluss der Gezeiten auf die Erdrotation, und gab (neben dem ihm unbekannten HALLEY) eine richtige Erklärung der Passatwinde und als erster überhaupt der Monsune. Erst heute gewürdigt wird seine geniale Konzeption der Möglichkeit verschiedener Geometrien (auch höherer Dimension) in verschiedenen, dann nicht aufeinander beziehbaren Welten. In bezug auf Erblichkeit, natürliche Anlagen und Keime hat er vieles gesagt, das ihn der heutigen Wissenschaft nahe bringt. Die Rolle, die er der Teolologie in der Erforschung der organischen Welt anwies, stellt ihn auch weit über seine Zeitgenossen. Auch seine Aethertheorie, die ihn viel beschäftigte, muss noch heute als eine geniale Konzeption angesehen werden. Neben dem allen finden sich aus den schon erörterten Gründen freilich auch wieder ganz unmögliche Spekulationen.

Nun muss ich zum Schluss noch auf den grossen, nicht verzeihlichen, wenn auch vielleicht einzigen Fehler des ganzen Werkes den Finger legen: Es hat keinerlei Index. Die *Nutzbarmachung* des besonders in den Fussnoten verstreuten ungeheuren Materials zur Geschichte der Naturwissenschaften ist dadurch fast unmöglich gemacht. Bei dem grossen Umfang des Werkes und der auf es ver-

wendeten Arbeit konnte es doch *darauf* nicht mehr ankommen. Schon ein verhältnismässig leicht herstellbarer Namenindex würde die Hauptwünsche erfüllen. Es ist heutzutage glücklicherweise selten geworden, dass Bücher dieser Art mit einem solchen Kapitalfehler behaftet in die Welt hinausgeschickt werden.

(Augsburg.) H. WIELEITNER.

Harvey Cushing. — *The Life of Sir* WILLIAM OSLER (1849-1919). 2 vol. XVI+685 pp.; XII+728 pp., many plates. Oxford, Clarendon Press; Oxford University Press, American Branch, New York, 1925. [$ 12 50]

The English (or Anglo-Saxon) way of writing a standard biography is to collect all the material available — diaries, letters, dated documents of any kind — and to classify it in strict chronological order. This being done (it often requires an enormous amount of labor and patience), one may cut this material into slices as thin as one pleases and proceed to write up each slice in its natural sequence, introducing in the text as many of the original documents as possible. Thus are produced in endless quantity these massive English biographies which used to frighten me so much. Is it not strange that the nation which has earned very rightly the reputation of greatest discretion and reticence should be also the one which publishes by far the largest number of extensive and circumstantial biographies? I said, this used to frighten and to shock me. The austerity of youth craves only for the essential: why bother about the trivial details of any man's life, however great? What we want to know is, in the first place, why this man was considered great by his fellow men and, in the second place, how he accomplished his appointed task. All the rest is gossip. — But as I grow older I become more frivolous; I begin to realize that much of that gossip is not simply interesting but important, I begin to long not only for deeds which are so great that they seem abstract, but for all the concrete little things, good and bad, which go so far to evoke the personality of a man. And, as a friend remarked to me: When one advances in age these minute biographies become one of the best substitutes for conversation... Well! I am almost converted. I still believe that the synthetic biographies are the real ones and as different from the English ones as history is different from mere chronicles — yet I have learned to love these chronicles.

And who would not love them, when written as this one is, with sufficient reserve and humor, with kindness always — and with a brisk raciness and gentle causticity which are the author's

earmarks ? For Dr. CUSHING has fully proved, for those who did not yet know it, that he can handle pen and scalpel with equal virtuosity.

It is hardly necessary here to describe OSLER's life. I shall simply recall, for the benefit of those who will turn to this journal for instruction, the main data. WILLIAM OSLER, the youngest son in a family of nine, was born July 12, 1849, in a parsonage at Bond Head, Tecumseth County, near the edge of the wilderness in what was Upper Canada. He came from sturdy stock. His father, the Rev. FEATHERSTONE LAKE OSLER, and the latter's bride, ELLEN FREE PICKTON, had arrived at Bond Head direct from Cornwall in 1837. He was a Celt; she, a native of London, one of those small, olive-complexioned English people, sometimes called « black Celts », who are thought to be remainders of the original Briton. (Sir WILLIAM had that same olive complexion.) To serve as a minister or as a minister's wife in those back woods was a very hard job, yet both of them lived long, the father dying in 1897, the mother ten years later, a centenarian. At the time of her hundreth birthday a few months before, she had three generations of descendants, six living children, twenty-six grandchildren, twenty-one great-grandchildren. It is interesting to note that Bond Head was the birthplace also of the father of F. G. BANTING, the discoverer of Insulin. Young WILLIAM was educated at Trinity College of Toronto, at the Toronto Medical School, and later at the McGill Medical School (Montreal). After a brief period of post-graduate study in London, Berlin and Vienna, he was appointed in 1875, professor at McGill. From 1875 to 1884 he remained in Montreal, from 1884 to 1889 in Philadelphia, from 1889 to 1905 at the recently founded Johns Hopkins University. All counted, thirty years of medical and clinical teaching in America — ten of them, in Canada, twenty in the United States. At that time he had the signal honor of being nominated Regius Professor of Medicine at Oxford.

The second volume of CUSHING's work — though larger than the first one — is entirely devoted to this last period of Sir WILLIAM's life — fifteen years out of seventy. This obvious disproportion is the graver in that those last fifteen years were years of comparative leisure and of apotheosis, rather than years of creation. Yet this is a natural result of the author's method — which I criticized once for all at the beginning of my review : The length of each part is bound to be proportionate, not so much to the importance of the corresponding period, as to the amount of material (chiefly letters) available. And then, those fifteen years included the war years, each of which counted for many. The war looms large in

Dr. CUSHING's work, and I do not complain of it, for the souls of men are better revealed as they appear in that crucible. The mental agony of those five years help us to fathom their depth, and measure their nobility. Thus, in the case of OSLER, — a man who could fight without hatred and hope without lies. And there was also, almost at the end, the greatest, the only tragedy of his life, the death, at the front in Flanders, of his only son, a boy of singular grace and promise, EDWARD REVERE (alias « ISAAC WALTON, junior »). If OSLER had died before August, 1917, at 68 instead of 70, he might have been pronounced one of the happiest men who ever lived. But « call no man happy till he dies ». Alas ! one terrrible tragedy among millions of others.

If one were to ask what Sir WILLIAM's achievements were, I would say :

First, he introduced clinical teaching in America, and was himself an ideal clinical teacher, a man whose medical knowledge was not hidden in books but entirely and immediately available.

Second, he wrote an excellent textbook (The Principles and Practice of Medicine) (1) which helped to mould the minds of more than a hundred thousand people; a textbook which was original, simple, and wise, and wherein he was not afraid to lay bare the limitations of the art. This textbook was the main cause of the interest taken in medicine about 1897 by Mr. JOHN D. ROCKEFELLER's grand almoner; it led to the creation, a few years later, of the Rockefeller Institute of Medical Research.

Third, he was a very efficient propagandist of public-health measures, preventive and social medicine.

Fourth — and not least — by his deep interest in the historical side of things in general and of medicine in particular, by his charity and humanism, he gave the profession an example of eternal value, and helped to raise its intellectual and moral standard.

To sum up, OSLER was rather a stimulator, an animator, than a creator. His Textbook is bound to be forgotten, but his exceptional qualities of mind and heart, his outstanding capacity for friendship, his humanism, will become legendary. Posterity will place him in the company of THOMAS LINACRE, ROBERT BURTON, Sir THOMAS BROWNE, JOHN BROWN, — a very small group of medical philosophers who were the constant guides of his own thought. That OSLER's wisdom was not entirely innate, but to some extent acquir-

(1) First edition 1892; eighth edition 1912, revised issue 1916.

ed, is well illustrated by the fact that it took him some time to understand the work of PASTEUR (as late as 1881 he was still apparently under BASTIAN's influence) (2) and, stranger still, that at the age of thirty-six he did not yet appreciate WALT WHITMAN !

I must not forget to mention OSLER's great services to medical history and bibliography : Dr. CUSHING, himself a passionate bibliophile, could be depended upon to dwell on that. He has done it so thoroughly, with such contagious gusto, that his biography I am afraid will remain a permanent focus of the bibliomaniac infection. Collecting rare books is a fine recreation, which brings forth many rewards of its own, but there is always a danger that the collecting instinct may degenerate into a form of greed, hardly more lovable than any other. OSLER was a great dilettante and a great lover of books, but he had managed early in life to sublimate this powerful instinct of his by the habit of collecting books for others — and not only for one institution but for many. In this case, too, he was acting like a ferment, a ferment of life and love.

Dr. CUSHING's work is of value also for the study of the medical life of our time, for he has tried — very successfully — to bring his hero into proper alignment with his contemporaries. To quote a single distance, the future biographer of Dr. W. H. WELCH will find in it much information of the first order. But it is not a true biography : let us hope that, after having produced this long series of microtomic sections, he may be persuaded to give us himself the real synthetic portrait which we need. Nobody could do it better, with greater knowledge and finer love. At any rate, whether he does it or not, the medical profession is greatly indebted to him. It is nothing short of marvellous that a great surgeon should have found time and, at the end of long, busy days, should have recruited enough strength and moral energy to build this monument — one that will endure.

GEORGE SARTON.

Thomas Francis Carter (1882-1925). — *The invention of printing in China and its spread westwards.* XVIII+282 pp., 40 illustrations and charts. New York, Columbia University Press, 1925. [$ 7.50]

The unfortunate reviewer who is obliged to read or at least to examine, day after day, hundreds of publications which are incorrect, superficial, or, at best, unnecessary, can have no greater joy

(2) PASTEUR's famous controversy with POUCHET about spontaneous generation had taken place almost twenty years before.

than suddenly to come across a book which is the fruit of honest, deep, and wise investigations, a book which he can admire without restriction and love without afterthought. Such a book is this one, but the reviewer's happiness is marred by the news of Dr. CARTER's premature death.

THOMAS FRANCIS CARTER was born in Boonton, N. Y., 1882.10.26. He obtained his B. A. at Princeton in 1904 and entered the Auburn Theological Seminary in 1906. In the course of a trip around the world in 1907 he spent a few months in China and began his study of the language. Returning to the United States, he completed his theological training at Union Seminary and was ordained to the Presbyterian ministry in 1910. He returned the same year to China and remained there twelve years, engaged in missionary and relief work. In 1922, shortly before leaving China, he was appointed director of all famine relief work in the northern part of Anhwei. At that time he supervised the construction of three hundred miles of roads and three hundred miles of dykes by fifty thousand laborers, disbursing more than half a million dollars in wages. In the mean while he continued his study of Chinese. Soon after this, while he was in Europe for study, he received an invitation to join the staff of the Chinese department of Columbia University; he became the head of the department in 1924. He was married in New York City, 1910.05.18, to DAGNY, daughter of Rev. OLE OLSEN, of Norway. He died in New York City, 1925.08.06.

It is strange to think that the history of Chinese printing had not yet been told completely by any occidental scholar, though some conjecture with regard to it had been published, as early as 1550, by PAOLO GIOVIO, in his *Historia sui temporis*. Fragmentary accounts had appeared from time to time, and I had myself studied quite a few of them, but this is the first work giving us the complete history, as far as it can be ascertained to-day. The author has made full use not simply of the occidental studies already published, but also of the Chinese encyclopedias, of the archaeological investigations carried on in Chinese Turkestan and in Egypt, and of the results of recent investigations recently published by Chinese and Japanese scholars. Moreover, in the course of his own research, Dr. CARTER has met practically all the leading sinologists of our time and has discussed with them the relative importance of the documents of which they happened to be the custodians or of which they had made a special study. A careful examination of the draft of this work was made by PAUL PELLIOT, who helped the author in the most generous manner.

It is thus safe to consider this work as a complete survey of the subject, in all of its ramifications, based upon the critical examination of all the material available, literary and archaeological, western and eastern. The account is brief, it contains nothing irrelevant, and yet in spite of its concision and pointedness, it is very readable. Because of the importance of this work I will indicate, chapter by chapter, the facts which it establishes (1).

Part I. — *The background of printing in China.*

1. *The invention of paper.* — This is the most certain and the most complete of China's inventions. Up to the end of the CHOU dynasty (255 B. C.), writing was done with a bamboo pen, with ink of lacquer made from tree sap, upon slips of bamboo or wood. The invention of a writing brush of hair ascribed to general MÊNG T'IEN (c. 220 B. C.) was soon followed by the use of silk rolls. Bamboo was too heavy, but silk was too expensive; something else had to be found. It may be conjectured that some near-paper made of silk fiber was already used in the first century of our era. The invention of real paper made of « tree bark, hemp, rags and fish nets » is traditionally ascribed to the eunuch TS'AI LUN, who made a report to the emperor on the subject in A. D. 105. This tradition, in itself very reliable, is amply confirmed by the discovery of fragments of *pure rag* paper dating of c. 150, in a watchtower of a western spur of the Great Wall (2). The use of paper made rapid headway and its manufacture was quickly and steadily improved.

« So far as an invention can ever be said to be completed, it was a completed invention that was handed over to the Arabs at Samarkand (757). The paper making taught by the Arabs to the Spaniards and Italians in the thirteenth century was almost exactly as they had learned it in the eighth. The paper used by the first printers of Europe differed very slightly from that used by the first Chinese block printers five centuries or more before. »

2. *The use of seals.* — The same word *yin* denotes both print and seal. The use of seals, first mentioned c. 255 B. C., became general about the beginning of the IIth century B. C. The seal itself was an improvement of an earlier method — the matching of the broken edges of a piece of bamboo or jade (3); the matching of broken edges led naturally to the matching of impression and die.

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(1) Some of these facts have been known for a considerable time, but my purpose is to outline the present state of our knowledge.

(2) Letters in the Sogdian language, also fragments in Chinese of about the same date. The discovery was made by Sir AUREL STEIN (1911).

(3) Cf. the tearing of a laundry check in the Chinese laundries of America.

This evolution may have been hastened in the last pre-Christian centuries by contact with Hellenistic civilization in Central Asia. The seal impressions of the Han dynasty were made, like those of Europe, in a soft substance (clay in China, wax in Europe) (1); but some time about the Vth or VIth century, as the use of paper increased, sealing with clay was gradually replaced by sealing with ink, the seal being used as we use a rubber stamp. Now the stamping of a seal with ink on paper is not very far removed from block printing. This new transition took place along two main lines — Taoist and Buddhist. The printing of Taoist charms was probably the earliest line of advance, but the earliest block printing extant consists of Buddhist charms (VIIIth cent.). — The seal was small, and its purpose was authentication; the block print was larger and its purpose was reduplication.

3. *Rubbings from stone inscriptions.* — When one studies the evolution within China of any idea, one must expect to follow three main threads which are constantly interwoven, the Taoist, the Confucian, and the Buddhist. We have already spoken of the Taoist and Buddhist threads; the Confucian is mainly represented by the old practice of taking inked rubbings from stone inscriptions. The cutting in stone of the Confucian Classics in order to secure permanency and accuracy goes back as far as the year A. D. 175. It would seem that rubbings were very soon taken from them, though the earliest rubbing extant dates only from the first half of the VIIth century. The same kind of crude lithography was carried on also in Buddhist monasteries. The greatest difference between stone inscriptions and wooden blocks is that the latter had to be cut in reverse, while the technique of rubbings made this unnecessary. Books from stone blocks continued to be published throughout the Sung dynasty, and in 1315 a large collection was thus printed in Japan.

4. *The dynamic force that created the demand for printing, the advance of Buddhism.* — In the whole history of printing, East and West, practically every advance anywhere was due to the religious impulse. Each of the three great missionary religions — Buddhism, Christianity, and Islam — contributed its share. In China, the dynamic force was, of course, Buddhism, this force being especially active between the IIIrd and VIIIth centuries.

Part II. — *Block printing in China.*

5. *The significance of block printing in China. The ink and the*

(1) However, Egyptians seem to have used ink stamps; there is, in Berlin, a red ink stamp on papyrus that dates from A. D. 85.

method used. — « For any land *the* invention of printing is the invention of that form of printing which transforms the education and culture of the nation. » Thus, from the European point of view, the invention of typography is the invention of printing. But as the Chinese have no alphabet, typography was relatively unimportant for them. « India ink », more correctly « encre de Chine », a true ink made from lamp-black (replacing the early ts'i or lacquer) was invented by a man named WEI TANG, who flourished in the IVth or Vth century. India ink is the best for use in block printing, and it is peculiarly indelible; on the other hand, it is not satisfactory for taking impressions from metal. Thus an essential step towards the Western invention of typography was the invention of another kind of ink, oily ink.

6. *The beginnings of block printing in the Buddhist monasteries of China.* — It is impossible to state when true block printing began. It was not in 593, as has been repeatedly said. The finds of Tunhuang and Turfan include many rubbings, stencils, and pounces, printed textiles, seals, and seal impressions, a profusion of stamped figures of Buddha. « Perhaps the nearest approach to an approximate date that can be given would be the reign of MING HUANG (712-756), the time when China's national greatness and China's cultural achievement reached their height. » This was unfortunately followed by a disastrous revolution, and later (845-859) by a frightful persecution of Buddhism under the influence of Taoism. Innumerable works of art and records were destroyed, and thus it happens that the earliest block print extant — dating from 770 — comes, not from China, but from Japan.

7. *The Empress* SHOTOKU *of Japan and her million printed charms c. 770.* — During the VIIIth and IXth centuries and especially during the Nara period (710-784), Chinese and Buddhist influences were paramount in Japan. The art of printing was imported together with every other feature of Chinese civilization. Among the treasures preserved at Nara are printed pieces of silk bearing the dates 734, 740. The Empress SHOTOKU, remembering the terrible smallpox epidemic of 735-737, showed considerable zeal in favor of Buddhism. She ordered the printing of one million charms, which were distributed c. 770. We have clear evidence of this, and some of these charms have been preserved to this day, being the earliest printed documents extant. They consist of fragments of the Vimala nirbhasa sutra, transliterated by means of Chinese characters.

8. *The first printed book. The Diamond sutra of 868.* — The earliest printed book extant, discovered by Sir AUREL STEIN in 1907

in the Caves of the thousand Buddhas at Tun-huang in Kansu (Eastern Turkestan), is a copy of a Chinese translation of the Diamond sutra, dated May 11, 868. This book (a roll sixteen feet long) shows already an advanced technique which implies a long preparation. It is distinctly superior to the early European block prints. On the other hand, the earliest clear reference to block printing in Chinese literature is an account of printed books seen by the official Liu Pin in the Province of Szechuen in 883. This early Chinese printing was almost exclusively Buddhist and Taoist; it was meant for popular consumption and seems to have been despised by the literati even as western typography was at first despised by the Italian humanists. As late as 932, the art of printing was apparently still confined to two localities, of which Szechuen was one.

9. *The printing of the Confucian classics under* FÊNG TAO *(932-953). Period of the Five Dynasties, 907-960.* — FÊNG TAO is considered by the Chinese as the inventor of printing. This is incorrect, of course, but he deserves to be honored because he did more than any other man to launch the invention and to develop its full cultural value. Under his direction, a standard edition of the Classics, with commentaries, was prepared by the National Academy. It was printed at Si-an-fu, between 932 and 953, in 130 volumes. The aim of this great undertaking was to fix for ever the correct text of the Classics. During this same troubled period, printing was introduced into Korea; the earliest Korean book is dated 950.

10. *The high tide of Chinese block printing. The Sung and Mongol dynasties (960-1368).* — FÊNG TAO's edition of the Classics inaugurated an enormous activity in printing. The conquest of the empire of Shu in 965 made it possible to amalgamate the printing establishments of Szechuen and China proper. The printing of the dynastic histories, in many hundred volumes, begun in 994, was completed c. 1063. Private printing spread throughout the empire. This activity continued under the Mongol dynasty, increasing in quantity but inferior in quality; it culminated, under the Ming, about the beginning of the XVth century. In the XIIIth and XIVth centuries (1293, 1330) some printing was done in Mongol as well as in Chinese.

The largest work printed under the Sung, and one of the largest ever printed, was the whole Buddhist canon (Tripitaka), which was published c. 972 : a collection of 1521 separate works (most of them translated from the Sanskrit) in more than 5,000 volumes, covering 130,000 pages. But of this, the official historians — good

Confucianists — do not speak ! This work was reprinted at least twenty times during the Sung and Mongol dynasties. An edition was printed in Korea in 1457 (6467 volumes).

A copy of this Chinese Tripitaka was brought to Japan in 987, but it was not until 1157 that the first book (of certain date) was printed in Japan : a Chinese version of the Diamond sutra. The Chinese Tripitaka was reprinted in Japan c. 1278-1288. Early printing in Japan was entirely devoted to Buddhism. The earliest Confucian work printed in Japan is a copy of the Analects dated 1364. « Up to this time Japan had printed nothing but Chinese translations from the Sanskrit. Now for two centuries she printed original Chinese works. It was not till the end of the sixteenth century, so far as known, that the first original Japanese work appeared in print — a copy of the Nihongi (Historical Records), printed with movable type. »

Buddhist printing spread also westwards among the Uigurs (Turfan) and the Tanguts (Kara-Khoto, 1016).

The works of LAO-TZU and CHUANG-TZU had been published already by FÊNG TAO, but the Taoist Canon was not printed completely before 1016. Two books of the Manichean scriptures were curiously included in one of the later editions of the Taoist canon. In 1328, a large number of almanacs (3,123,185) was printed, a special edition being prepared for the use of Muslims. There is as yet no evidence of early Christian printing in China.

11. *The printing of paper money.* — The issue of paper money (or « flying money ») can be traced back at least to the beginning of the IXth century, but there is no evidence that that money was printed. It is probable that the first issue, or large issue, of printed money coincided with the great printing accomplishments of the first half of the Xth century. By the end of the following century (c. 1094-1107) too much money had already been printed, and a rapid inflation had started. During the XIIth and XIIIth centuries the Chinese government had constantly to struggle with a falling currency and rising prices. Apparently none of the early notes has survived; the earliest dated notes of certain authenticity date of c. 1375. Bank notes were also printed in Japan between 1319 and 1327. « The clear facts that concern this history are that during the four centuries before GUTENBERG a form of printing was going on that issued not only millions, but actually billions, of notes, and scattered them to every hamlet in China, that this printing of paper money extended at one time as far west as Persia (Tabriz), and that it was so interesting to European travellers that no less than eight of them described it. »

Paper money is the one form of Chinese printing which was noticed by medieval travellers, it is the one form which was carried on in Persia. Yet there was no printing of paper money in Europe till the issue of 1658 in Sweden.

Part III. — *The course of block printing westward.*

12. *Early commerce in thought and in wares along the great silk ways.* — This is a brief but excellent summary of our present knowledge on the trade and cultural relations between the West and the Far East, beginning under the HAN and culminating under the YÜAN dynasty. That the West had for so long so little clear knowledge of China is explained by the fact that few (if any) caravans went the whole distance : goods and ideas were carried by relays and people at the one end of the line could not know much about people at the other end.

13. *Paper's thousand-year journey from China to Europe.* — One has evidence of the *manufacture* of paper in the following places : China, 105; Tun-huang, before 150; Loulan c. 200; Niya 250-300; Turfan 399; Samarkand 751 (first paper mill in Islam); Bagdad 793; Damascus; Egypt c. 900 or earlier; Fez c. 1100, Xativa 1150; Hérault 1189 (first paper mill in Christendom); Montefano 1276; Venice; Nuremberg 1391; England 1494; Dordrecht 1586; Philadelphia 1690. In many cases the earliest import of paper preceded the local manufacture by from one to two centuries. The advance of paper was thus very slow but we can trace its course with great accuracy, while the advance of block printing is very obscure: this is due to the fact that the appearance of paper marked everywhere a tangible discontinuity, while the introduction of block printing was so gradual that it often was imperceptible. Furthermore, there was less demand for paper in Europe than in Asia, for parchment was a better writing material than bamboo slips or papyrus. « While it was the coming of paper that made the invention of printing possible, it was the invention of printing that made the use of paper general. »

14. *The printing of the Uigur Turks in the region of Turfan.* — Description of the rich treasure of documents dicovered in the Turfan basin, Chinese Turkestan, by ALBERT GRÜNWEDEL and ALBERT VON LE COQ in 1902. Turfan became in the VIIIth century and remained until 1206, the capital of the Uigurs, a Turkish tribe of Manichaean faith. Turfan had always been a focal point where all kinds of races, religions, and languages met — hence the enormous variety and polyglottism of the documents there discovered : seventeen languages are represented, some of them appearing in four or even five different alphabets. All the block prints found

are Buddhist. None is dated, but they are probably of the XIIIth century or the first half of the XIVth. Six languages are used : Uigur (Turkish, written in the Sogdian alphabet), Chinese, Sanskrit, and, to a smaller extent, Tangut, Tibetan, and Mongol. The Uigur printing is in many respects the most interesting. « These Buddhist printed books in a Turkish language with Sanskrit notes and Chinese page numbers, in a script brought from Syria, are in themselves an epitome of the eclectic character of the Uigur civilization. » Then also they illustrate the rôle played by Turkish peoples in the spread of printing. In the Xth century the greatest part of Asia was under Turkish rule. Moreover, when the Uigurs were conquered by the Mongols in 1206, their civilization was taken over *in toto* by the new empire.

15. *Islam as a barrier to printing.* — The Muslims are strongly prejudiced against printing : with the exception of the abortive project of 1729 at Constantinople, the Islamic world never printed a book till 1825, when the first press was set up at Cairo. The Muslims, who remained for half a millenium the best agents in the distribution of paper, were, on the contrary, antagonistic to the diffusion of printing. This diffusion was thus largely stopped until the Muslim barrier had been penetrated, from the East, by the Mongols, and, from the West, by the Crusaders.

16. *The meeting of China and Europe in the Mongol empire.* — Put these two facts together : (1) For a century or more (c. 1250 to c. 1350) the contact between Europe and the Far East was far closer than ever before and probably closer than at any subsequent period down nearly to the XIXth century; (2) Block printing appeared in Europe towards the end of the XIVth century. The author does not hasten to suggest a causal relation between these two facts; on the contrary, he is extremely conservative, but he points out carefully all the incidents which made a causal relation possible. I enumerate them briefly : Block printing in Mongolia; printing by the Mongols in China; the Mongols raided Hungary and Poland in 1241, 1259, 1285; they settled in Russia in 1223, 1236-1240, and Russia remained in Mongol hands for more than two centuries, Nijni-Novgorod becoming a center of distribution of Far Eastern goods; early embassies from the Pope and the French King to the Mongol court; Marco Polo; European missionaries in China; European merchants and travellers.

17. *Persia, the crossroads between the East and the West.* — There is no place, however, where the contact between Occident and Orient was greater than in the Persia of these days, and especially in the cosmopolitan town of Tabriz. The great Rashîd al-dîn who

lived in Tabriz and completed there, in 1317, his Universal History gave a clear account of early Chinese printing. In the same city some paper money, printed in Chinese and Arabic, had been issued in 1294, Tabriz being thus the only place in Islam where there is a clear record of early printing.

18. *Block printing in Egypt during the period of the Crusades.* — Some fifty fragments of block printing included in the enormous collection of documents found near Crocodilopolis (Arsinoë) c. 1880 (Archduke RAINER Collection in the Austrian National Library) form almost the only evidence of the printer's art between China and Central Asia on the one hand and Europe on the other. These fragments are all written in Arabic and date from c. 900 to 1350; they are all of a religious nature. Considering the technique, the religious subject matter and the materials used, also the fact that Egypt was under Turkish influence from the IXth century on, it is probable that this Egyptian printing was a development of Asiatic printing.

19. *Playing cards as a factor in the westward movement of printing.*

« Printed playing cards were in common use in China before the Mongol conquest; immediately after the Mongol period cards began to appear in Europe and were recognised as of Eastern origin; either from the first or soon after, these cards were printed; playing cards were among the first, if not altogether the first, block prints in Europe; and the printing of cards constituted an important industry both in Venice and in southern Germany in the early part of the fifteenth century. While it is not safe to say with certainty that playing cards in coming from China to Europe brought block printing with them, the evidence is at least sufficient to suggest that among the possible ways by which block printing may have entered the European world, the use of playing cards holds an important place. »

20. *The printing of textiles.* — It is probable that some sort of resist printing was done in Egypt in Roman times; however, the oldest Egyptian printed textiles (resist prints on cotton) date only from about the VIth century. The oldest European printed textile, found in Arles, dates from the first half of the same century. The oldest Japanese specimens are dated 734 and 740. The printing of textiles made little advance in Europe until the (XIIth), XIIIth and XIVth centuries (1); the technique was now very different, and in

(1) The earliest textile printer mentioned by name in Europe is JAN DE PRINTERE of Antwerp, 1417 (p. 248)

some of them the picture rather than the fabric became the center of interest. This must have led to block printing. Yet almost every printed textile of whatever origin is purely ornamental, while early printing on paper was essentially religious.

21. *Block printing in Europe.* — It is probable that block printing began in Europe within the last quarter of the XIVth century. The earliest dated document is a picture of St. Christopher, 1423. It is difficult to say when the earliest block books appeared, but the dated ones are later than GUTENBERG's work It is probable that the earliest undated block books appeared a few years before the invention of typography and that their existence was one of the causes of that invention. Paper began to be manufactured in Nuremberg in 1391, and it was paper that made printing worth while. « There would have been little use in a cheap method of duplication, if the only material available had been as expensive as sheepskin. GUTENBERG's Bible was one of the few early books printed on parchment, and each copy of GUTENBERG's Bible is said to have required the skins of three hundred sheep. » Was the impulse to print stimulated from without? That is quite possible; the circumstantial evidence is strong but a complete proof cannot be given.

Part IV. — *Printing with movable type.*

22. *The invention of movable type in China.* — During the period 1041-9, PI SHÊNG invented typography. He used type made of clay and experimented also with wooden type. This invention was improved by other men, chiefly by WANG CHÊN who invented and described in 1314 a new kind of wooden type and revolving tables to store the type within easy reach of the typesetters. The reality of these inventions has been fully confirmed by the discovery of a font of wooden type dating from c. 1300 in the caves of Tun-huang.

23. *The great expansion of movable type printing in Korea.* — The invention of typography was revived in Korea in 1403 when the great King TAI TSUNG ordered the casting of type of metal. The value of the invention was at once fully appreciated. At least three fonts were cast before the invention of typography in Europe : in 1403, 1420, 1434, — enormous quantities of type being produced and a large number of books printed. Many of these books (the earliest dated 1409) and specimens of each of the early fonts are still extant today. The Koreans invented the type mould; they also invented a certain alphabetization of their language but they failed to see the obvious merit of an alphabet from the typographical point

of view : thus their invention, just like that of the Japanese *Kana*, complicated their printing instead of simplifying it. The Korean use of type spread to China and Japan but only after the time of GUTENBERG.

My long analysis gives no idea of the wealth of detail which can be found in CARTER's work. His final conclusions are the following:

« The introduction of paper from China is certain ; the influence of Chinese block printing on European printing rests on such strong circumstantial evidence as to be accepted with a reasonable degree of certainty ; little or no reliable evidence has yet been found to show that the typography of China or Korea influenced that of Europe... But the great outstanding fact that has been shown by this inquiry is the parallelism in the working of the human mind on the two sides of the world, a parallelism that has been manifest at every stage in the history of printing.

» Of all the world's great inventions, that of printing is the most cosmopolitan and international. China invented paper and first experimented with block printing and movable type. Japan produced the earliest block prints that are now extant. Korea first printed with type of metal, cast from a mould. India furnished the language and the religion of the earliest block prints. People of Turkish race were among the most important agents in carrying block printing across Asia, and the earliest extant type are in a Turkish tongue. Persia and Egypt are the two lands of the Near East where block printing is known to have been done before it began in Europe. The Arabs were the agents who prepared the way by carrying the making of paper from China to Europe. Paper making actually entered Europe through Spain, though imported paper had already come in through the Greek Empire at Constantinople. France and Italy were the first countries in Christendom to manufacture paper. As for block printing and its advent into Europe, Russia's claim to have been the channel rests on the oldest authority, though Italy's claim is equally strong. Germany, Italy and the Netherlands were the earliest centers of the block printing art. Holland and France, as well as Germany, claim first to have experimented with typography. Germany perfected the invention, and from Germany it spread to all the world. Great Britain and the United States, the two countries that to-day do the bulk of the world's printing, are the two great nations of the world that lay no claim to having had a part in the invention, at least in its early stages, and have contented themselves with such later developments as the power press and the linotype. »

I said at the beginning of my review that this was a book which I could admire without restriction. But alas! nothing human is perfect. CARTER's work seems irreproachable; it is the result of a careful and almost exhaustive examination of all the documents and monuments bearing on the subject; it is judicious, clearly and

forcibly written. It is perhaps a little too didactic and there are many repetitions which intelligent readers do not need. My only criticism, however, concerns the form of the book. To be sure it is beautifully printed and magnificently illustrated, but the shifting of all the footnotes at the end is very inconvenient. The notes are classified by chapter, and are then followed by a bibliography classified in the same manner, and there are many cross-references between these parts. Thus the careful reader is obliged to interrupt his reading at every moment and to refer to three or four different pages in order to appreciate the information which is offered and even for such trivial matters as checking a Chinese name. This is irritating to a degree. The index too is not as good as it should be. But for all that, the work is splendid and will remain an everlasting monument to the author's memory.

GEORGE SARTON.

Alfred Forke. — *The world-conception of the Chinese. Their astronomical, cosmological and physico-philosophical speculations.* XIV+300 p. London, PROBSTHAIN, 1925.

We are very glad to have at last FORKE's work, the publication of which had been unduly delayed for many years. This work is very valuable because it is essentially based upon the Chinese sources and because the most relevant Chinese texts are quoted both in translation and in Chinese script. That is, some of the main documents are offered to the reader in the most convenient way (there is no language for which the presence of the original text is more needed). The appearance of this volume is particularly welcome because there has been of late a renewal of interest in the work of the Sung philosophers. Witness, for example, the volumes recently devoted to CHU HSI by J. PERCY BRUCE and his translation of the Hsing Li (*Isis* V, 499, VI, 148). The philosophical value of this so-called Confucian revival has been greatly overrated. It is not the least merit of FORKE's investigations, that they enable us to measure more accurately the originality, or rather the lack of originality, of CHU HSI and his school. That was essentially a syncretic movement, an enrichment (or shall we say, an impoverishment), of Confucian thought with a mass of ancient lore chiefly of Taoist origin. The author has taken considerable pains to trace the development of that lore in early Chinese literature, and this being done, he compares every item with the corresponding one in « modern » philosophy, that is in the so-called Neo-Confucian philosophy of the XIth and XIIth centuries. (By the way FORKE remarks

on p. 101 that this Sung philosophy began in the Xth century; is that not a mistake ? Was there much done in that direction before the time of CHOU TUN-I [1017-73]?)

FORKE's work is divided in four books as follows : 1. The Universe; 2. Heaven (this ought to have been followed by a study of the Chinese Hell); 3. Yin and Yang; 4. The Five Elements. Each time the ancient views are traced as far as possible to their sources in Chinese literature, then the « modern » Chinese views are quoted. The author makes very frequent comparisons with the views of other peoples, most of them primitive peoples, on the same subject. We feel very thankful to him for the extensiveness of his comparisons but their main result is to emphasize the primitiveness and, under a veneer of scholasticism, the crudity of the Chinese views.

There is very little of that, if anything, which deserves to be called « science ». In fact the whole work is a painful study in scientific aberration. Therefore I can not take much interest in the discussion started by the much lamented ED. CHAVANNES as to whether the theory of Five Elements was original to the Chinese or whether, as he claims, they borrowed it from the Turks. For there is practically nothing in that of scientific interest. The Empedoclean theory, crude as it is, seems a masterpiece of scientific thought in comparison. Indeed it is difficult to see anything more in the Chinese notions of Five Elements, Five Emperors, Five Spirits, Five Sacrifices, Five Animals, Five Grains, Five Viscera, Five Numbers, Five Colors, Five Sounds, Five Tastes, Five Smells, Five Points, Five Creatures and what not, than a childish love of classification and symmetry. FORKE says that the Turks would never have thought of that because they possessed very little originality, — but was much originality needed? To develop such theories what was most needed was not originality, but rather the opposite, a scholastic type of mind such as the Chinese undoubtedly possessed.

My main hobby (the study of ancient Chinese painting) has inspired to me the deepest admiration for the Chinese people and, if I am prejudiced, it is rather in their favor. But much as I love them, I am obliged to admit that they were great artists, that they showed considerable genius in practical affairs, for instance in the arts relative to printing or in husbandry, but that they were the weakest theoricians of all civilized peoples, ancient and modern. It is true they did some very extraordinary work in mathematics, the formal nature of which appealed to them; their world-conceptions were not scientific in any sense, but an intolerable mixture of scholasticism and superstition.

As it is, FORKE'S memoir is an important contribution to our knowledge of Chinese thought. Its only defect is the lack of an index. In a work of this kind, this is truly unpardonable, — a discredit to author and publisher alike.

GEORGE SARTON.

Robert Theodore Gunther. — *Early science in Oxford*. Vol. III, XII+564 p., many plates and text figures. Oxford. Printed for the subscribers, 1925.

The first two volumes of this series, which appeared in 1920 and 1923, were fully reviewed in *Isis* VI, 449-53. The third volume is even better than the previous ones with regard both to the text and to the very rich illustration. The first two volumes were devoted to mathematics and to the physical sciences; this one, to the biological sciences. The compilation of this history was suggested to the author by his idea of publishing illustrations of all zoological specimens once forming past of the historic Tradescant collection. The photographs produced in this third volume were thus the first of the whole work to be taken.

This volume is divided into two main parts, of which the first is a historical introduction (246 p.) and the second a study of the ancient biological collections of Oxford University together with a *catalogue raisonné* abundantly illustrated.

The first part deals successively with Early Medicine, Medicine in the XVIIth century and after, Anatomy, Physiology, Zoology, Botany, and Geology. This history is very readable. Being focussed upon local interests and collections, it is naturally less a history of ideas than a history of persons and local events; it is largely biographical, anecdotic and antiquarian. The author succeeds in giving us some very good sketches of the personalities of those great investigators to whom ungrateful Oxford owes so much of her fame : BOYLE, HOOKE, WREN, LOCKE, MAYOW, RECORDE and of many another. I will not attempt to summarize that record, and the more so that much of it is necessarily of greater interest to Oxford men than to other students.

The *catalogue raisonné* is divided as follows : Biological collections of the University; Bodleian and Anatomy School; The Ashmolean Museum; the Clarendon Science Museum; the collections of the Colleges; the oldest museum specimens; aids to study. This last chapter gives us some idea of the methods of study used in Oxford during the XVIIth and XVIIIth centuries.

The most interesting section is probably that dealing with the TRADESCANTS, who by the way were not of Dutch extraction, but came probably of an East Anglian stock. JOHN TRADESCANT THE ELDER (1587? — 1637 or 1638) had travelled through Europe to Russia and had collected in Barbary and in several of the Mediterranean Islands; JOHN TRADESCANT THE YOUNGER (1608-1662) collected in Virginia and other places. Together they assembled what must have been one of the richest collections of rarities of the time in the « Tradescant's Ark » at South Lambeth. The collection was bequeathed to ELIAS ASHMOLE, who gave it in 1677 to the University. The history of the Ashmolean Museum, as told by the author, is full of human interest. Its scientific interest is also considerable, for any specimen of the present collections which can be referred to the Tradescant period is to be valued as being the oldest type-specimen of its kind now extant in any museum. The author's policy of publishing a large number of photographs of these objects was thus a wise one and increases materially the usefulness of his work.

Another interesting section is the one, well known of course to ornithologists, devoted to the Dodo. Unfortunately but little is left of the TRADESCANT « Dodar from the Island Mauritius », which, becoming decayed by time and neglect, was finally « a Museo subducta, annuentibus Vice-cancellario aliisque Curatoribus, ad ea lustranda convocatio, die Januarii 8vo, A. D. 1755 ».

With regard to the herbaria, I was surprised to find that the oldest one preserved in Oxford dates back only to 1606, 300 specimens collected in N. Italy by GREGORIO OF REGGIO; the next in point of time is that of JACOB BOBART, 2,000 specimens from the Oxford Garden, 1656-70. There are six other important herbaria of the XVIIth and XVIIIth centuries; the total number of specimens of that period being about forty thousand.

To be sure many of the « rarities » collected by the TRADESCANTS and their emulators had no scientific value, but the historian — from whom, as from a physician, nothing must be hidden — is as much interested in the queer and foolish rarities as in the others, for they help him to reconstruct the intellectual background of the period. I quote a few items for the sake of illustration. In the Anatomy School according to the catalogue of 1709 :

Nos. 190. A Blackmoore mummied.

45. A Mermaid's hand.

329. Capilitium una cum cute a vivo Americano detractum poena talionis in Barbaros, qui e nostris captivos, illum

in modum excamificant, palisque alligatos, solis ardoribus, et vesparum, asilorum, aliorumque insectorum morsibus objiciunt.

175. Two sceletons in Green Frames, the one of a Man, the other of a Woman that had 18 husbands. (From St. John's College Library, where they were seen by EVELYN, 1654 [who pronounced them 'finely cleansed and put together'] and by BENTHEM, 1694.)

25. A Woman's skull, with the Suture called *Sutura sagittalis* continued quite to the Nose.

204. An Irish skull with Moss upon it.

239. Unicorn's horn.

286. The head of Hippo-potamus or Behemoth.

In Ashmole's list (c. 1656):

A shirt without a seame or stich 2 yds longe.

A headres of a vestall of crisped tiffany, etc.

All honor to the author for the pains he has taken to preserve these treasures and to make them better known (see *Isis* VI, 542). Oxford could afford to lose the Unicorn's horn and other « rarities » of the same type, but the loss of many other specimens is irreparable. For example the geological collections formed by MARTIN LISTER (1638?-1712) and ROBERT PLOT (1640-96) and enriched by the addition of the fossils of EDWARD LHWYD (1660-1709) comprised no less than 1,766 specimens; of all of these XVIIth century specimens I understand that only *two* remain in the University Museum. Let us hope that this book and the existence of the new Museum, largely due to GUNTHER's initiative, will bring Oxford to her senses and preclude the possibility of further losses. The author's zeal for the study of the scientific past of his university is very refreshing but in one instance (p. 66), carries him too far : « We feel inclined to ask : Is the world any the better for LOCKE's Philosophical writings? It is certainly the poorer for his defection from the study of Medicine. » This is the only statement to which I must take exception. The fact that JOHN LOCKE did not make a name in medicine but became a great philosopher is sufficient proof of his greater fitness for philosophy than for medicine.

This volume which concerns more directly the Oxford antiquarian and the student of early modern science, will prove of great interest also to the historian of museums and the student of museology.

GEORGE SARTON.

E. J. Dijksterhuis. — *Val en Worp. Een Bijdrage tot de Geschiedenis der Mechanica van* ARISTOTELES *tot* NEWTON. VIII + 466 p. gr. 8°. Groningen, P. NOORDHOFF, 1925. [Brosch. Fl. 7,50]

Es gibt bedeutende und « bedeutende » Historiker. Unter denen in Gänsefüsschen verstehe ich die illustren Männer, die dicke Bände geschrieben haben, die in aller Händen sind, über die man sich aber bei eigenen Untersuchungen ärgert, so oft man sie zur Hand nimmt, da immer dies und jenes, wenn nicht falsch, so doch flau oder schief ist (nomina sunt odiosa). Die bedeutenden Historiker ohne Gänsefüsschen können auch viel geschrieben haben (wie z. B. PAUL TANNERY); aber alles, was sie schrieben, war, selbst wenn es hypothetisch war, wohl überlegt, alles Tatsächliche gut begründet, die Quellen soweit möglich vollständig, sorgfältig und kritisch gelesen. Es ist eine Freude, solch einen Historiker noch nach Jahrzehnten zu studieren.

Die vorliegende Arbeit über die Entwicklung der Fallgesetze reiht den Verfasser sofort in die Klasse der bedeutenden Historiker ohne Gänsefüsschen ein. In der kleinen Stadt Tilburg angestellt, musste er sich jedes Buch erst von auswärts kommen lassen. Was er trotzdem an entlegenster Literatur beigeschafft hat, grenzt ans Unglaubliche. Obwohl selbst einigermassen mit dem Gegenstand vertraut, kann ich dem Verf. keinen anderen tatsächlichen Irrtum nachweisen, als dass er — zu verzeihlich — übersah, dass unterdessen ALBERT VON HELMSTEDT (von Sachsen) doch mit ALBERT VON RUECKMERSDORFF (p. 78) als identisch nachgewiesen wurde (*Isis* V, 219).

Seine Unterlagen, insbesondere die umfangreichen Schriften von P. DUHEM, hat Verf. mit sorgfältiger Kritik benützt. Seine Urteile über die Quellen sind überall wohl überlegt. So kommen DANNEMANN, E. MACH, W. OSTWALD u. a. an den zitierten Stellen (das Werk hat ein sehr gutes Namenregister) nicht ganz gut weg, R. CAVERNI wird stark verurteilt.

Was die Originalquellen betrifft, so tritt die Bedeutung N. ORESME's gebührend hervor (auch die Arbeiten des Ref. sind dabei erschöpfend herangezogen), LEONARDO DA VINCI beurteilt Verf. mit L. OLSCHKI noch geringer als schon DUHEM, GALILEI wird bewundert, aber doch auch kritisiert. Insbesonders beweist Verf. eingehend, dass GALILEI noch an dem alten ARISTOTELischen Fehler festhielt, die Geschwindigkeit der Kraft proportional zu setzen, und dass er überhaupt nicht so « modern » war als vielfach noch angenommen wird. Eigentlich eine historische Selbstverständlichkeit (auf die auch gelegentlich F. POSKE hingewiesen hat).

Gegenüber DESCARTES, der noch mitten in der Scholastik steckte, wird aber GALILEI mit Recht als der weitaus Fortgeschrittenere bezeichnet.

Auch die Form des Werkes ist ganz ausgezeichnet. Alle zahlreichen Zitate sind bibliographisch einwandfrei und schön geordnet hinter den einzelnen Kapiteln gesammelt. Die vielen Originalstellen sind alle in der Ursprache und in holländischer Uebersetzung gegeben. Druck und Ausstattung des Buches sind sehr gut. Die Sprache wird keinen wirklichen Gelehrten von der Lektüre abhalten. Für Volkslesebibliotheken ist das Buch, das aber sonst sehr klar geschrieben ist, nicht bestimmt.

H. WIELEITNER.

(Augsburg.)

Edmund O. von Lippmann. — ***Geschichte der Rübe (Beta) als Kulturpflanze von den ältesten Zeiten an bis zum Erscheinen von*** ACHARD'S ***Hauptwerk*** (1809). Festschrift zum 75 jährigen Bestande des Vereins der deutschen Zuckerindustrie. Mit einer Abb. Berlin, 1925, JULIUS SPRINGER. VIII+184 S. [geb. 12 Mk.]

Eine Monographie der *Rebe* und ihrer edlen Frucht zu schreiben möchte wohl manchem eine dankbare Aufgabe scheinen. Der Rebe verdanken wir den Wein, und was seit Jahrtausenden über den Wein geschrieben und gedichtet worden ist, würde eine Bibliothek füllen. Dass aber auch ein so unpoetisches Gewächs, wie die *Rübe*, der Ehre teilhaftig geworden ist, in einem gelehrten Werke behandelt zu werden, verdankt sie der Eigenschaft, die sie mit den Trauben teilt, ihrem Zuckergehalt. Reift die Traube in der Sonnenglut unseres Nachsommers, entwickelt das Zuckerrohr nur in tropischem Klima seine höchsten Erträge, so hat fortgesetzte Auslese aus der gemeinen Runkelrübe eine zuckerreiche Rasse gezüchtet, die für die kühleren Klimate, im Grossen angebaut, die Grundlage einer volkswirtschaftlich unermesslich wichtigen Zuckererzeugung geworden ist.

Man braucht es nicht besonders hervorzuheben, dass der Verfasser der 1890 erschienenen *Geschichte des Zuckers* in diesem kleinen Buche alles gibt, was eine jahrzehntelange Vertrautheit mit den Aufgaben der Zuckerfabrikation und eine immer wieder zum Staunen zwingende ungeheure Belesenheit in jeder Art Literatur zu der Frage der Kultur der Zuckerrübe und ihrer Stammpflanze beibringen konnte. Es ist nicht des Verfassers Schuld, wenn die alten und ältesten Nachrichten oft zu unbestimmt sind, um sichere Entscheidungen zu gestatten. Dass von den Landwirten und den Gärtnern, die die verschiedenen Gattungen von Rüben pflanzten und

verwerteten, diese besser unterschieden worden sind, als von manchem Schriftsteller, der dem praktischen Garten-und Feldbau ferner stand, dem alles Rübe war, was eine dicke, essbare Wurzel besass, ist wohl keine Frage. Wie viele unter hundert Stadtbewohnern mögen selbst heute wissen, dass die weissen, gelben und roten Rüben drei grundverschiedenen Pflanzenfamilien angehören? Sucht man aber über die Hauptfrage ins Klare zu kommen, wann und wo aus irgend einer wilden oder bereits veredelten Form von Beta sich die besonders zuckerhaltige weisse Rübe herausgebildet hat, so steht man fast unüberwindlichen Schwierigkeiten gegenüber (S. 144). Als wahrscheinlichste Ansicht gilt dem Verf., dass die Kulturform aus dem Hauptverbreitungsgebiet der salzliebenden Chenopodiazeen, dem inneren Asien, ihren Weg südwärts und westwärts genommen hat. Allerdings wird ihre Heimat von namhaften Botanikern auch im Mittelmeergebiet gesucht. In wie weiten Grenzen die Pflanze nach Wuchs und Lebensdauer, Form und Farbe von Blättern und Wurzel sowohl wild wie in Kultur variiert, bildet ein besonders lehrreiches Kapitel (S. 152-163).

Die im Hauptteil des Buches gesammelten geschichtlichen Nachrichten führen vom älteren Griechenland und Italien, Aegypten und Orient durch das Mittelalter und die neuere Zeit bis an den Anfang des 19. Jahrhunderts wo dann die Zuckergewinnung aus der Rübe durch MARGGRAFS Entdeckung und ACHARDS bahnbrechende Arbeiten in die Wege geleitet wird. Einzelheiten aus der Stoffmenge herauszuheben, muss ich mir versagen. Ich merke nur noch an, dass dem Buch eine genaue Nachzeichnung der Abbildung der Beta beigegeben ist, die der berühmte Wiener Dioskurides-Codex enthält. Man sieht grosse Blätter und eine Pfahlwurzel, die Pflanze wurde also um jene Zeit offenbar als Blattgemüse gebaut.

JULIUS RUSKA.

Heidelberg.

Harry Elmer Barnes. — *The new history and the social studies*, 8° XVII+605 p. The Century C°. New York, 1925.

Ce volume vient à son heure, car il est certain qu'on s'intéresse de plus en plus à cette conception très large de l'histoire que M. BARNES appelle « New history ». Voici comment l'auteur précise le but de son livre : « the specific purpose of the volume is first to sketch the general nature of the newer or dynamic and synthetic history, and then to indicate in logical succession the contributions of the various social sciences to the methods and subject matter of history, as well as to make clear the ways in which the genetic approach to their data is of value to all the social sciences » (p. IX).

Dans un premier chapitre on trouve les idées de l'auteur sur la « nouvelle histoire ». Résumons-les brièvement : l' « ancienne histoire» presque uniquement politique donnait une idée aussi mauvaise que possible de la société humaine; elle considérait les événements politiques comme les plus importants. Elle est condamnée aujourd'hui parce qu'on a compris que le seul lien dans la succession des faits historiques est l'intelligence humaine. La nouvelle histoire exposera donc d'une manière « intelligente » quand et pourquoi la civilisation actuelle naquit : c'est la seule manière de distinguer ce qui y est essentiel des simples survivances du passé. Mais on n'est pas d'accord sur la méthode à employer et M. BARNES compte jusqu'à huit écoles d'historiens qui se complètent plus qu'elles ne s'excluent « they may be designated as the personal or great man theory; the economic or materialistic; the allied geographical or environmental; the spiritual or idealistic; the scientific; the anthropological; the sociological; and the synthetic or collective psychological » (p. 31).

Les chapitres II et suivants sont consacrés aux différentes sciences qui ont contribué à étendre le champ de l'histoire : ce sont la géographie, la psychologie, l'anthropologie, la sociologie, la technologie, l'économie, l'économie politique et la morale. Naturellement, la méthode varie suivant les chapitres : mais en général l'auteur commence par parler de la nature et des progrès de la science qu'il étudie, pour passer ensuite à ses rapports avec l'histoire et à son importance pour l' « histoire nouvelle ». Toutes les sciences envisagées n'ont pas la même importance : aussi la morale et l'anthropologie sont-elles traitées assez rapidement alors qu'une grande attention est prêtée à la sociologie et à la psychologie. Enfin le livre se termine par un court chapitre consacré à l'influence de la « nouvelle histoire » et des sciences sociales sur les réformes sociales.

Bien que la tâche de M. BARNES ait été très délicate, nous croyons qu'il l'a bien remplie. Sauf quelques paragraphes (notamment au chapitre final) son étude est très claire et très précise. Son esquisse préliminaire qui définit la « nouvelle histoire » est excellente dans sa concision. Pourtant nous ne sommes pas toujours de l'avis de l'auteur : nous attachons plus d'importance que lui à l'histoire politique dont il rabaisse le rôle et dont il dit qu'elle est « an incomplete and melodramatic exposition of a superficial and distorted view of human society and social evolution » (p. 9). L'histoire politique est incomplète, c'est entendu, mais elle est plus nécessaire que M. BARNES ne veut l'admettre. Pour lui, l'avenir est à l'interprétation psychologique et sociologique de l'histoire (p. 195 et 319) : il a

raison en partie, mais il exagère certainement — au détriment des sciences économiques — l'influence que la psychologie et la sociologie peuvent avoir sur l'histoire. Certes, M. EMERTON a tort de vouloir bannir la sociologie du curriculum universitaire mais nous croyons comme lui qu'il serait dangereux de revenir à la philosophie de l'histoire; et — M. BARNES a beau le nier — c'est à quoi nous exposent la psychologie et la sociologie. D'ailleurs beaucoup des exemples cités par M. BARNES pour prouver que ces deux sciences ont aidé à comprendre le passé ne sont guère convaincants : il n'est pas du tout vrai, par exemple, qu'il faut être sociologue pour saisir que la chute de l'empire romain ne s'est pas produite comme un cataclysme! (p. 363).

Tel quel, ce volume rendra les plus grands services. L'historien y trouvera une mine de renseignements précieux. Si quelques appréciations sont un peu hasardées en revanche le livre fourmille de jugements excellents sur les hommes et leurs œuvres.

Voici quelques remarques de détail. FUSTEL DE COULANGES ne semble pas apprécié à sa juste valeur. L'English Constitution de W. BAGEHOT reste-t-il vraiment le meilleur livre en son genre? (p. 154). Excellente appréciation de l'œuvre de GUSTAVE LEBON (p. 164 sqq.) qu'on a trop exaltée dans certains milieux. La civilisation romaine n'a pas péri à cause de l'infiltration pacifique des barbares (mauvaise comparaison avec l'émigration aux Etats-Unis et affirmation gratuite de la supériorité anglo-saxonne!) (p. 167). Excellentes notes sur l'importance de la civilisation celtique (p. 23) et sur la variation de l'influence du facteur géographique suivant les périodes (p. 70). Le rôle de l'Eglise est sous-estimé (*passim* et p. 249). Très bon résumé des différentes divisions de l'histoire économique (p. 441 et sqq.). Trop d'énumérations de noms propres (notamment pp. 32, 91, 196, 300, 303, 474). M. BARNES a une tendance à exagérer le rôle de l' « Ecole historique » de Columbia — à laquelle le livre est d'ailleurs dédié.

GASTON G. DEPT.

(Université de Gand.)

Hans Jensen. — *Geschichte der Schrift.* Mit 303 Abbildungen. VIII + 231 S. Folio. Orient-Buchandlung HEINZ LAFAIRE. Hannover 1925. [Geb. 40 Mk]

Tier und Mensch haben das Bedürfnis gemeinsam, sich über innere Zustände und äussere Lage zu verständigen. Welche Mittel in Anwendung kommen, ist durch die Umwelt und die Organisationshöhe bestimmt. In der Tiefsee, wohin kein Lichtstrahl dringt,

wird die Wahrnehmung feiner Schwingungen des Wassers eine Art Orientierung über Freund und Feind ermöglichen. Aber die Natur hat für jene Welt auch Lichtsignale und Teleskopaugen erfunden. Insekten werden ausser durch die Augen vor allem durch einen unendlich feinen chemischen Sinn zu den Nahrungsstellen oder den Artgenossen hingeleitet. Der Urwald hallt wider vom Geschrei der Tiere, die sich nicht sehen können, und aus gleicher Notlage wird die Trommelsprache der Neger entstanden sein. Körperbewegungen und Modulationen der Stimmen verraten bei höheren Tieren innere Erregung oder Reaktion auf die Umwelt, jene vom Auge, diese vom Ohr aufgefasst und gedeutet. Gleichen Ursprungs ist die Symbolik der Gedanken, die sich beim Menschen zu *Sprache* und *Schrift* entwickelt hat.

Die Entwicklung der Sprache liegt jenseits aller Geschichte, ja wohl jenseits dessen, was wir Vorgeschichte des Menschen zu nennen gewohnt sind. Die Entwicklung der *Schrift* können wir heute noch, eben weil die Schrift sichtbar fixiert ist und nicht wie das Wort verhallt, bis zu ihren ersten Anfängen zurückverfolgen. Unentwickelte Sprachzustände, ich meine solche, die zwischen tierischen Lauten und grammatischer Durchbildung stehen, sind uns nicht bekannt. Auch die ursprünglichsten der heute lebenden wilden Völker besitzen vollkommene Sprachen von oft wunderbarer Gliederung. Primitive Schriften aber kennen wir in grosser Zahl, sowohl solche, die auf der Stufe der Bildschrift stehen geblieben sind, wie andere, deren Entwicklung zur symbolischen Darstellung von Begriffen und Lautkomplexen fortgeschritten ist. Diesen Prozess in allen seinen Formen und Verzweigungen zu verfolgen ist eins der reizvollsten Probleme der Psychologie, der Ethnologie, der Paläographie und der Sprachwissenschaft, um nur die wichtigsten Gesichtpunkte zu nennen, unter denen die Fragen behandelt werden können.

Ich entsinne mich noch des tiefen Eindrucks, den FAULMANNS Werk auf mich machte, als ich es um 1880 als Schüler in die Hand bekam. Damals war die Hauptarbeit der Aegyptologen und Assyriologen bereits getan, man hatte die Entzifferung von Hieroglyphen und Keilschrift im wesentlichen bewältigt, auch war die auf den ersten Blick so unfassliche Tatsache bekannt, dass alle Buchstabenschriften der Welt im wesentlichen einer einzigen Quelle, dem altsemitischen oder phönizischen Alphabet entstammen. Aber wie viel neue unbekannte Schriften und Sprachen hat die Forschung seit einem halben Jahrhundert neu entdeckt und entziffert, und wie vieles ist auch heute noch problematish ! So war es wirklich ein dringendes Bedürfnis, den Stand der Dinge aufs neue zusammen-

fassend zu beschreiben, und wir dürfen den Verfasser beglückwünschen, dass er den Plan nicht nur gefasst, sondern auch mit Hilfe eines opferwilligen Verlegers, dem besonderer Dank gebührt, durchgeführt hat. Hoffen wir, dass das Werk bei jeder neuen Auflage an Vollendung und Brauchbarkeit gewinnt und sich für den Forscher, der eine Orientierung über den Gegenstand braucht, wie für jeden Leser, der das Werk aus Interesse an der Sache in die Hand nimmt, zum unentbehrlichen Handbuch weiter entwickelt.

Die Einteilung des Stoffs ist durch die Natur der Sache gegeben. JENSEN beginnt mit den Vorstufen der Schrift, wie sie in Form von Kerbstöcken, Knotenschnüren usw. als Gedächtnishilfen vorhanden sind oder in den bekannten praehistorischen Felsskulpturen und Indianerzeichnungen auftreten, die als Piktographien bezeichnet werden und den Uebergang zur Bilderschrift vermitteln. Der erste Abschnitt des der *Wortschrift* vorbehaltenen Teils ist den Bilderschriften der Azteken und Maya gewidmet, jener hochstehenden amerikanischen Völker, die von den Spaniern samt ihren Bücherschätzen in wenigen Jahrzehnten zugrundgerichtet wurden. Es folgt eine lichtvolle Darlegung über die chinesische Schrift und die Gründe ihrer Unersetzbarkeit durch eine Lautschrift nach europäischem Zuschnitt. Einen jedem Beschauer fühlbaren Gegensatz dazu bildet dann die wundervoll künstlerish wirkende Hieroglyphenschrift der alten Aegypter, deren Entzifferungsgeschichte wir immer wieder mit Bewunderung für CHAMPOLLION und seine Nachfolger lesen. Hinreichend anschaulich sind auch die besondern Schwierigkeiten geschildert, die sowohl die Lesung der auf so heterogene Sprachen angewandten Keilschrift, wie die Klarlegung ihrer Entwicklung aus Bildern bereitet hat. Dass man nocheinmal auf die unglückliche Idee von FR. DELITZSCH zurückkommen wird, sogenannte Urzeichen und Urmotive heranzuziehen, halte ich nicht für wahrscheinlich. Kürzer, vielleicht allzukurz ist die chetitische Schrift besprochen, der im Stil auch die altkretische Schrift nahesteht. Von den Silbenschriften ist mit Recht der japanischen eine bevorzugte Stelle eingeräumt. Den grössten Raum des Buches beansprucht die Geschichte der Buchstabenschrift.

Einen Ehrenplatz in der Schriftgeschichte muss man der altpersischen Keilschrift einräumen. Mit den geistvollen ersten Entzifferungsversuchen von GROTEFEND 1802 beginnt bekanntlich die Geschichte der Keilschriftforschung. Ich würde es begrüssen, wenn der Verf. bei einer Neuauflage die Darstellung der Entzifferungsgeschichte, insbesondere auch der babylonischen Keilschrift, noch etwas erweitern wollte. Was die Achämenidenschrift anlangt, so wird deren letzter Herausgeber WEISSBACH wohl Recht behalten,

wenn er sie ein künstliches Gebilde nennt, das zu monumentalen Zwecken der altbabylonischen Schrift auf Stein nachgebildet worden ist.

Dass danach das gerade in den letzten Jahren wieder in Fluss geratene Problem der altsemitischen Konsonantenschrift ausführlich behandelt werden musste, versteht sich ohne weiteres. Man darf wohl sagen, dass die Versuche, diese Zeichen aus der babylonischen Keilschrift abzuleiten, gescheitert sind, und dass ihr enger Zusammenhang mit der ägyptischen Schrift, die ja schon selbst eine Menge reiner Konsonantenzeichen besass, durch die Funde am Sinai trotz aller noch entgegenstehenden Schwierigkeiten erwiesen ist. Die weitere Geschichte dieser genialen Schöpfung, der abgesehen von China fast die ganze schreibende Menschheit ihre Schriftzeichen verdankt, füllt die letzten hundert Seiten des Werkes.

Eine reiche Auswahl von Schrifttafeln, Druckproben und andern Abbildungen begleitet die Darstellung. Hier möchte ich für künftige Auflagen den Wunsch aussprechen, dass sämtliche Abbildungen, auch diejenigen, welche am Kopf einen Hinweis auf ihre Bedeutung tragen, Unterschriften erhalten. Trotz des grossen Formats konnten nicht alle Abbildungen auf der Seite untergebracht werden, zu der sie gehören. Wird dann noch an andern Stellen auf sie zurückgegriffen, so ist Suchen lästig. Man wird auch gern die Reihe der Tafeln repetendo durchsehen, und braucht Unterschriften, um sich ihre Bedeutung einzuprägen. Umschriften der zusammenhängenden Textproben zu verlangen, würde vielleicht zu weit gehen, aber ich glaube, sie wären manchem Leser lieber als die beigefügten Uebersetzungen unlesbarer Texte. Mancher würde gewiss gern die Texte an der Hand solcher Umschriften genauer verfolgen.

Auf Einzelheiten, die zu beanstanden wären, einzugehen ist hier nicht der Ort. Etwas stiefmütterlich scheint mir die syrische, arabische und tibetanische Schrift behandelt zu sein. Dass die syro-malabarische Schrift als Karschuni bezeichnet wird, war mir neu; der Name haftet sonst an arabischen, mit syrischen Buchstaben geschriebenen Texten und muss wohl von daher übertragen sein. Für das Arabische sollte eine besser geschnittene Druckschrift angewandt werden, und für Schikäste (Abb. 187) gäbe es gewiss auch bessere Vorlagen.

Ich schliesse die Anzeige in der Hoffnung, dass der Verf. die an dem Buche gemachten Ausstellungen und die ausgesprochenen Wünsche als Zeichen des lebhaften Interesses entgegennehmen möchte, das ich für sein Werk habe. Möchte es recht zahlreiche Leser finden.

Heidelberg. JULIUS RUSKA.

John Ruhrāh. — *Pediatrics of the Past.* An Anthology. With a foreword by FIELDING H. GARRISON. XXVI+592 pp., 54 text ill., 18 pl New York, PAUL B. HOEBER, 1925. [§ 10]

In compiling this handy anthology, the author, professor of diseases of children at the University of Maryland, has rendered a great service to his fellow pediatrists. It will now be very easy for them, not only to obtain some acquaintance with the history of their profession, but even to read some of the main early classics which are here reproduced *in extenso*. They will have little excuse for ignoring any longer the origin and evolution of their art. The work originated as follows : Lieut.-Col. GARRISON, the master of American historians of medicine, was invited to prepare a History of Pediatrics for Dr. ABT's System of Pediatrics. In endeavoring to ascertain the status of the more recent textbooks and systems, the analysis of which is not the historian's province, but a *question de métier*, he applied to a number of leading pediatrists of the country for an expression of opinion. Among these, RUHRAEH was particularly helpful, and himself took so much interest in the game that he gradually conceived and compiled the present anthology.

The work begins with some extracts from the writings of HIPPOCRATES, SORANUS, ARETAEUS, ORIBASIUS, AETIUS, PAUL OF AEGINA, and RHAZES. After a brief transitional chapter dealing with the little we know of mediaeval pediatrics, the author examines the *incunabula :* PAULUS BAGELLARDUS, Padua 1472; BARTHOLOMAEUS METLINGER, Augsburg 1473; CORNELIUS ROELANS, Louvain c. 1484. English translations of these incunabula are provided (pp. 28-138).

XVIIth century : LEONELLI FAVENTIDE VICTORIUS. De aegritudinibus infantium. Ingolstadt 1544. — Translation and adaptation of the De partu hominis of EUCHARIUS RÖSLIN by RICHARD JONAS and THOMAS RAYNALDE, 1540, etc. — THOMAS PHAER (1510?-1560), the Father of English Pediatrics; his Boke of Children (1544 [?], 1545), is given in full (pp. 147-195). — FELIX WUERTZ (1518-1574 or 76). His Practica der Wundartznei. Basel 1563 (English translation, London 1656) contains a little book on children, the first after HIPPOCRATES to treat of infantile orthopedics. This booklet is also published in full (pp. 196-220). Says GARRISON : « It is one of the most striking things in all medical literature... what arrests our attention is the splendid humane spirit of the author. » — HIERONYMUS MERCURIALIS (1530-1606). Nomothelasmus. Padua 1532. De morbis puerorum. Venice 1583. — FELIX PLATTER (1536-1614), son of THOMAS. His Observationes in hominis affectibus, Basel 1614, contains the first description of thymus death. — GUILLAUME

DE BAILLOU (BALLONIUS) (1538-1616), who described whooping-cough in 1578. — SIMON DE VALLEMBERT (c. 1565).

XVIIth century : PHILIP GERHARD GRUELING (1593-1667), chemist. Tractat von Kinderkranckheiten, Nordhausen 1660. — FRANCIS GLISSON (1597-1677). He wrote a treatise on rickets (De rachitide, 1650), which is almost perfect. We are given the essential of it verbatim from the contemporary English version (pp. 254-284). — ROBERT PEMELL (?-1653). De morbis puerorum. London 1653. — FRANCIS SYLVIUS (1614-1672). Praceos medicae liber quartus. De morbis infantum. Amsterdam 1674. — RICHARD WYSEMAN (1622-1676). — THOMAS SYDENHAM (1624-1689). — J. S. 1664. — JOHN MAYOW (1643-1679). — WALTER HARRIS (1647-1732). De morbis acutis infantum. London 1689. — THOMAS THACHER (1620-1678). Author of the first American pediatric publication, 1677-1678. — WOLFGANG HOEFER (1614-1681). His Hercules medicus, Vienna 1657; first description of cretinism.

XVIIIth century : NILS ROSÉN von Rosenstein (1706-1773), professor at Upsala and Stockholm. — WILLIAM CADOGAN (1711-1797). — A full view of all the diseases incident to children, London 1742. Anonymous anthology. — ROBERT WHYTT (1714-1766). Observations on the dropsy of the brain. Edinburgh 1768. — BENJAMIN RUSH (1745-1813), who was first to connect Cholera infantium with hot weather. — HEZEKIAH BEARDSLEY (1748-1790), who gave a remarkable description of congenital pyloric stenosis. New Haven 1788. — SAMUEL THOMAS SOEMMERING (1755-1830). His Abbildungen und Beschreibungen einiger Misgeburten, 1791, contains the plate showing an example of achondroplasia or chondystrophy. It is this same SOEMMERING who, in 1809, invented a primitive form of electrical telegraphy, and he may be counted one of the ancestors of embryology. — GEORGE ARMSTRONG (?-1764). — MICHAEL UNDERWOOD (1737-1820). Treatise on the diseases of chidren. London 1784. — SAMUEL BARD (1742-1841). Enquiry into the nature, cause and cure of the Angina suffocativa. New York 1771 (diphtheria).

After this follows a long section (pp. 465-518) on pediatric poems from the XVth century on, and finally a chapter on the HEBERDENS : WILLIAM HEBERDEN (1710-1801) and his son WILLIAM (1767-1845). The latter's Morborum puerilium epitome appeared in London, 1804, and an English translation in the following year. This translation is here reprinted *in extenso*. It is a very remarkable production, which still belongs to the previous century, and the more so in that it was probably composed by the elder WILLIAM, the greatest clinician between SYDENHAM and BRIGHT.

This collection is fitly closed by a reprint of an old bibliography -- FRIEDRICH LUDWIG MEISSNER (1769-1860) Leipzig 1838 — which the author has tried to complete up to 1880. The book is abundantly and beautifully illustrated.

GEORGE SARTON.